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INTERNATIONAL

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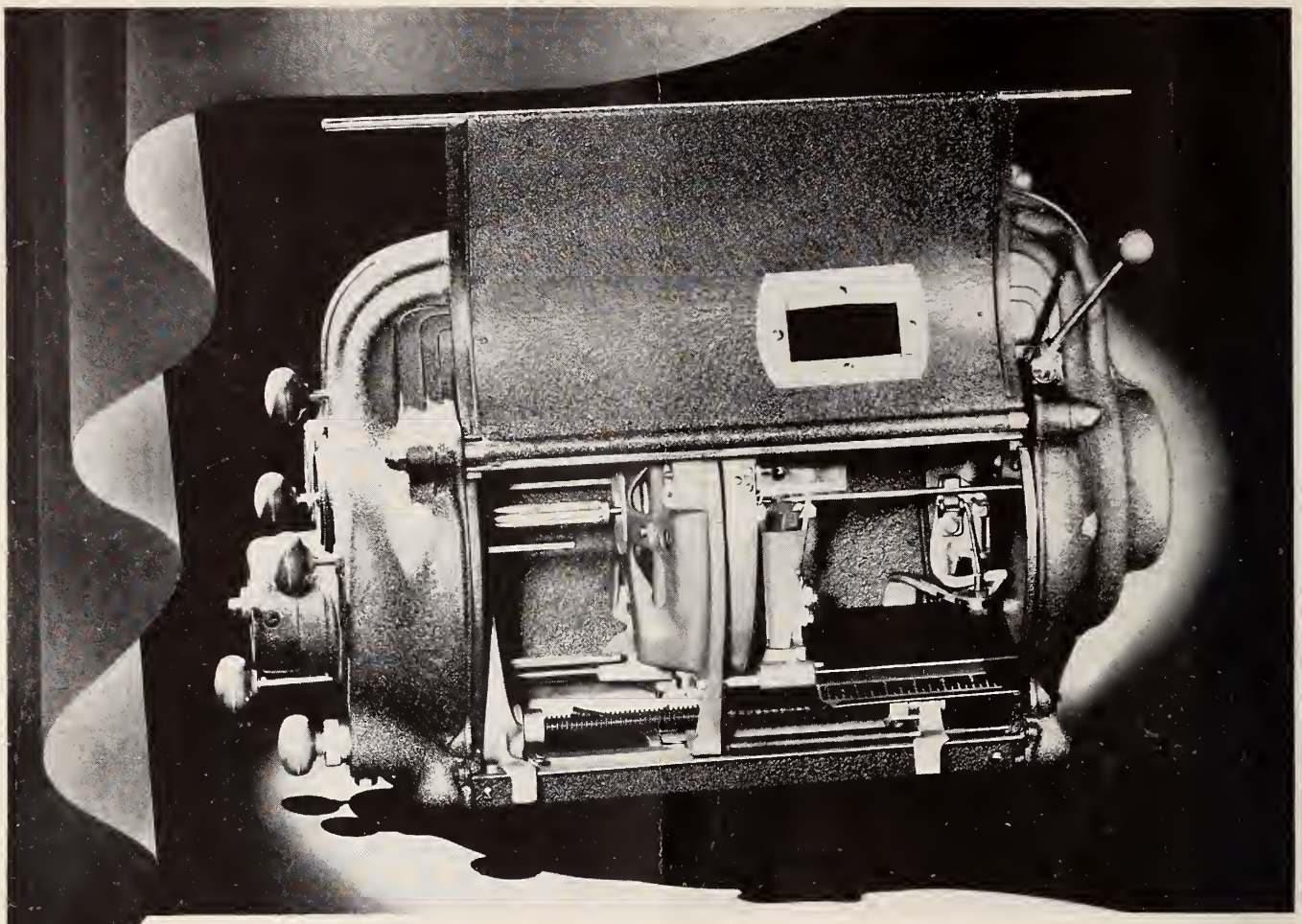
JANUARY 1940

VOLUME 15 • NUMBER 1

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The RCA Photophone Mercury Fader Switch makes this change-over positive and noiseless. It prevents sound interruptions and fading.

With contacts permanently sealed in a mercury-filled glass tube (shown on fingertips at right) the Mercury Fader Switch ends all worry about corrosion and makes cleaning unnecessary. In addition, the gases and carbon dust present in the booth have no effect on the efficiency of the switch.

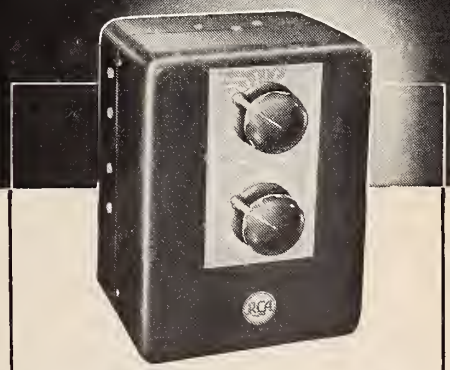
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JAN 14 1942

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 15 JANUARY 1940 *Number 1*

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Monthly Chat

LOEW'S Theatres, currently showing "Gone With the Wind," are putting out the finest projection we have ever seen, expressed in terms of both quantity and quality of the projected light. The answer to which is, of course, the new Bausch & Lomb coated lens and condenser combination. Loew's picked up all 27 such sets that were made available for GWTW, thus occasioning loud and long wailing among the other projection supervisors. The next batch will not be ready before April 1.

"Terrific" is the proper descriptive word to apply to this latest advance in visual projection. An interesting angle on this new setup is the fact that many patrons unversed in the art of projection go out of their way to compliment theatre managers on the screen image, which is the tip-off on the quality of this socko optical development. Projectionists handy to a Loew's theatre should rush right over and take a look-see at this gorgeous projection.

Meanwhile, elsewhere in this issue appears the technical dope on this lens-condenser combination, of which more anon.

• • •

The ravings and rantings of exhibitor groups that the opposition of organized Labor to the Neely Bill, now awaiting congressional action, reflects an "unholy alliance" between employer and worker, should not deter a single projectionist from writing to his Congressman and registering his opposition to this pernicious measure. This bill will not only "murder" the studio craftsmen but it will also put such a crimp in theatre operation as to result in numerous closings. Innumerable A. F. of L. units, including hundreds of I. A. local unions, have registered their opposition to this bill. Individual action on a wide front will help to bury this obnoxious measure, which is just a prelude to government control of the cinema art. *Get busy!* Just a few lines to your Congressman in Washington. A postcard will suffice.

• • •

The current surge in the lamp manufacturing field should not sweep the alert projectionist off his feet. The manufacturers are handing out great gobs of informative data anent these new arcs, which activity is all to the good. However, before purchasing new arc lamps, Mr. Projectionist, who is the only technically-minded fellow in and about a theatre, should be sure that the *particular type* of lamp favored will serve best the interests of his theatre.

New equipment which ill fits a particular operation is worse than struggling along with the old units. Take a good look at all new lamp jobs, and don't approve any purchase simply for the sake of geting something new.

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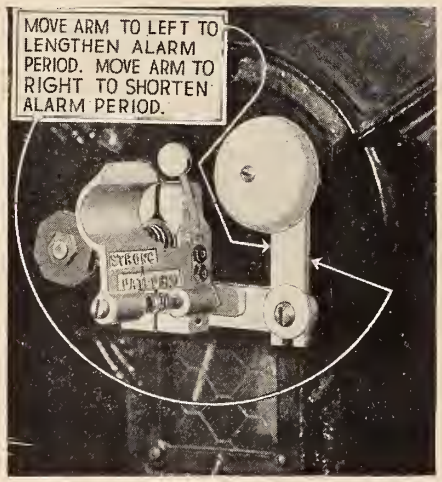
Is strictly mechanical and requires no batteries, no transformers, no governors, and no pre-setting by the projectionist.

Is not dependent upon any change in the normal smooth operation of the projector.

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Once installed, forget it—as was conclusively demonstrated by 1200 tests under practical conditions in various projection rooms.

About 75 seconds before the end of the reel the bell begins to ring, continuing distinctly for 15 seconds, after which period of time it ceases. The duration of the bell-signal can be increased or decreased about 15 seconds by simply moving the arm to either the left or the right.



The Strong Reel-End Signal Is

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ZIPPER Changeovers for all models mount directly on the projector at the aperture and can be installed within 10 minutes without any drilling or tapping, etc., and require no brackets! A new-type treadle foot-switch, utilizing an unbreakable mercury switch, eliminates all switch trouble. Weighs only 20 ounces; guaranteed against trouble for one year after purchase.

The combination Sound-Vision Changeover is now available in all ZIPPER models for use with any RCA sound installation. This method of changeover is EXCLUSIVE with the STRONG ZIPPER, being fully covered under U. S. Patent No. 1,796,970. These combination models for RCA systems are priced at $125 per pair, including foot-switches.

ZIPPER Changeovers available for Simplex (all models) Motiograph (all models) and Kaplan projectors.

●

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INTERNATIONAL PROJECTIONIST

VOLUME XV JANUARY 1940 NUMBER 1

An Electronic Carbon Arc Control

By *GEORGE W. SWITZER*
MEMBER, I. A. LOCAL UNION 551

Numerous attempts to get away from the conventional arc regulatory device now in use have resulted in a varied assortment of controls—most of which missed the mark by a wide margin. The idea of an electronic arc control, the topic of the accompanying article, while not new, has been unproductive of any practicable results up to now.

Mr. Switzer's device is entirely feasible, and publication of the data thereon may induce helpful comment from the field; at least, it will serve to focus attention of those ingenious projectionists upon this engaging subject. Patent thereon is pending.

SINCE the development of the Suprex carbon the writer has been trying to develop an arc control that would positively maintain the carbon arc gap at the proper length, not be too bulky, be easy to set and maintain, and be comparatively simple in operation. The result of these endeavors is a vacuum tube arc control—and it works!

Any number of arc regulatory devices have been tried over the years. There have been specially wound motors, thermostats, and, in a few cases, photoelectric cell controls. None of these unconventional methods has enjoyed any degree of success, for the reason that the voltage and amperage change at the arc is so slight that none of these devices possessed the sensitivity to detect the variation in current and go into action to correct the situation before the change was noticeable on the screen.

Thus we have a situation today wherein all lamp manufacturers have settled on constant-feed motors to do the job of arc regulation; yet it cannot be denied that such an arrangement necessitates manual adjustment to correct for voltage changes and for variation in carbon construction. Hard and soft spots are common enough in present day carbons, despite the many advances made by the carbon company engineers. Consequently, the arc requires constant attention in order to keep it from "freezing" or going out.

Assuming that there were no variation in carbon construction, a constant-feed motor, which utilizes a variable rheostat to control the speed, would be suitable for this job; but this still would leave unsolved the problem of variation in either line or generator voltage.

● Arc Gap Requisites

All we projectionists are aware of the importance of maintaining a proper carbon arc gap: either we observe a tolerance of at least ⅛ inch of the set space or there will be no proper crater and the projected screen light will be subject to considerable variation. Manual adjustment intended to correct an improper arc gap condition disrupts the gas ball formed at the arc and results in unnatural tinting of the projected light.

The vacuum tube arc control described in this article will positively maintain a carbon arc gap to within 1/32 inch of its set and proper spacing and will eliminate the need for any manual adjustment by the projectionist. In order to achieve this result it was necessary to assure detection of the slightest voltage change at the arc while the carbons were burning either to or away from each other, and to insure immediate operation of a relay controlling the speed of the arc feed motor.

The writer found that the vacuum tube provided the only device possessing sufficient sensitivity to detect this comparatively minute change, and around this idea he developed the aforementioned control with its positive action and complete freedom from any guesswork or chance. Since we all are familiar with the action of vacuum tubes, we can proceed to consideration of the control itself.

● Details of Control

The control has two meters ranging from zero to 10 volts at 1000 ohms per volt and have a one-milliamp draw—that is, they draw one milliamp of current for a full-scale reading and can therefore be read to 1/10 volt. The relay is an 8000-ohm job designed to work on the output of the plate of a vacuum tube and draws 1-22/100 milliamps. The power supply is a half-wave rectifier. Tubes are a 6J7 and a 6F6.

Part of the arc voltage is fed to the grid of the first vacuum tube through resistances, one of which is variable and controls the No. 2 meter. The No. 1 meter is connected to the cathode circuit of this vacuum tube and also

has a variable resistance to control the grid bias. The weak impulse from this tube is fed into an output tube through an audio transformer to build it up so as to obtain sufficient current to operate the relay.

The unit has its own self-contained power supply. The relay is so connected that when the points are open there is just enough current flowing, through set resistances, to keep the arc-feed motor barely turning (the relay controls the fields of the arc feed motor). When the points are closed the resistance is shunted out of the circuit and the motor runs at full speed.

In use, we set the arc voltage on the No. 1 meter to read 3 volts. This feeds into the vacuum tube grid, creating a 3-volt positive bias and causes a current flow. We now adjust the grid bias meter to read 3 volts also, and as both voltages are now equal, there will be no plate flow of current and the relay does not operate (and remains open).

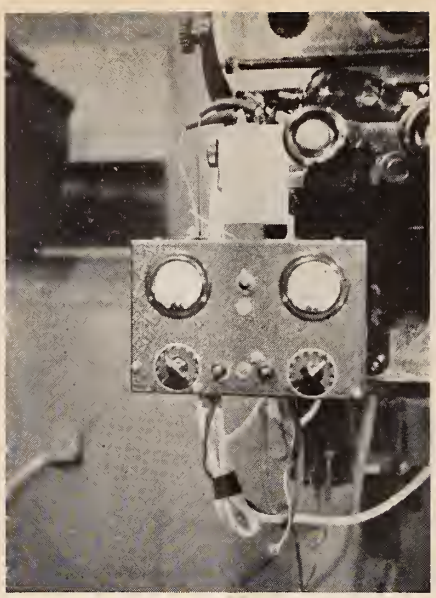
Now, if the carbons at the arc burn away from each other, to cause as little as 1/10 volt change, there will be just that much less negative current on the tube, which is increased by the audio amplifier and causes the relay to close. As aforesaid, closing the relay speeds up the motor and brings the carbons back into their correct position, at which point the relay opens and the motor slows down.

The carbon arc gap spacing will be kept within 1/16 inch of its set distance, and even less. The carbons cannot "freeze" by this method because as they try to close up, the grid of the tube becomes negative and the arc feed motor is kept almost dead still. It will be seen that with the use of this control there is always a perfect crater at the arc and that the proper distance is maintained without variation.

● Voltage Variations

Now, with regard to a change in line voltage. If the voltage rises, the grid bias also rises a little in proportion, and *vice versa*. There would have to be quite a change in line voltage to be noticed, also it would have to persist for some time to affect the arc or control. However, if there be such, all that is necessary is to reset the grid bias meter at the designated voltage—3 volts—and this difficulty is overcome.

If the generator voltage varies either up or down, it is taken care of by the control itself in the following manner: part of the grid bias voltage is furnished by the voltage drop across the arc, and as the generator voltage rises or falls, the grid bias is raised



The electronic arc control mounted on projector

or lowered in the same proportion, thus the meters are always kept in step with each other. [Note: in tests, I have raised the voltage and also lowered it as much as ten volts for various periods of time with no effect on the arc or the spacing.]

The writer has made various tests on different lamps, namely, Peerless, Brenkert and Preddy, and have had exceptional success with this control. After installing the control, he has not once had to correct the arc on any lamp nor touch the control. In one theatre especially, where the projectionist complained of an undue amount of arc trouble, he installed the control and did not have occasion from then on to correct the arc. The projected light was perfect and did not vary in intensity for a single instant. This test was made through four double and one single reels of film.

The control may be built into a lamp itself, or as a separate unit which can be installed in a few moments time. It requires no changes in the carbons or lamp, no changes in motor or wiring, nor alterations of the projection equipment, and it can be attached easily to any lamp.

In making the aforementioned tests on the different types of lamps and under different generator and line voltage conditions, the writer visited a number of theatres. There, in more a demonstration than a test, I have met many projectionists and managers, and the manager of the National Carbon Co. branch of San Francisco. Each was enthusiastic about and commented favorably upon the positiveness of the control, its simplicity, ease of operation, inexpensive cost, and small size.

FILM CARRYING BY THEATRE EMPLOYEES OUT IN MICH.

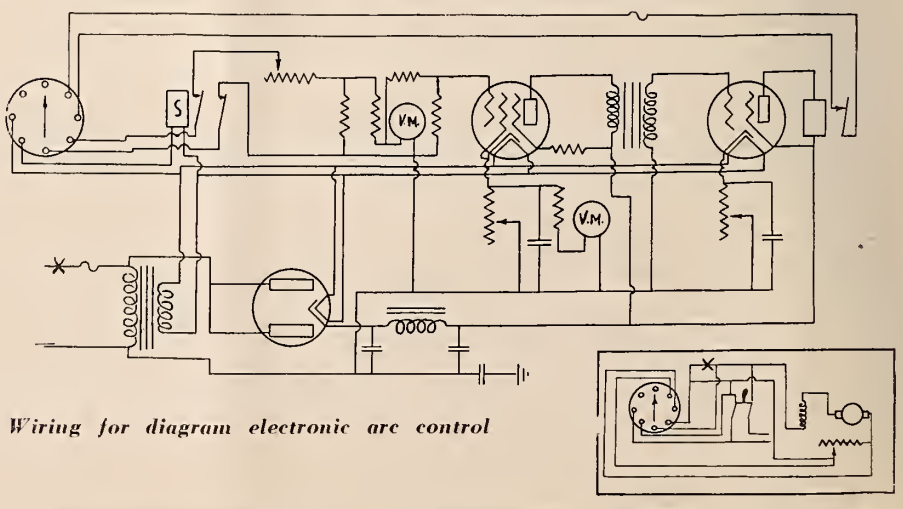
Ruling against theatre employees transporting film went into effect for the Michigan exchange territory on Jan. 15, according to Roger Kennedy, vice-president of the IATSE. Plan is aimed against "Will calls," and is attributed to the fact that such calls have increased to the point where they are taking a substantial part of the business away from established film carriers.

Ushers, doormen, and managers alike are barred under the new rule. Possible modification will be considered in individual cases of owner who desires to transport his own to save expenses.

ERPI'S 'INDUSTRIAL STETHOSCOPE'

An "industrial stethoscope" for the diagnosis and checking of running machinery has been announced by ERPI. The Recording Frequency Analyzer (as the new device is called) discloses the "'sound" condition of motors undergoing test, and records the results on a graph automatically.

The equipment employs frequency analysis by the "sweep" method, using a small drive, motor to actuate the frequency dial which sweeps the whole range of frequencies from 30 to 10,000 cycles per second. With this motor is synchronized another motor driving a band of graph paper on which a stylus traces the sound level at each frequency passed. Sharpness of frequency selection from the great variety of sound that the microphone picks up from a whirring machine is assured by the finest available crystal filters.



Wiring for diagram electronic arc control

The New 19000 Series

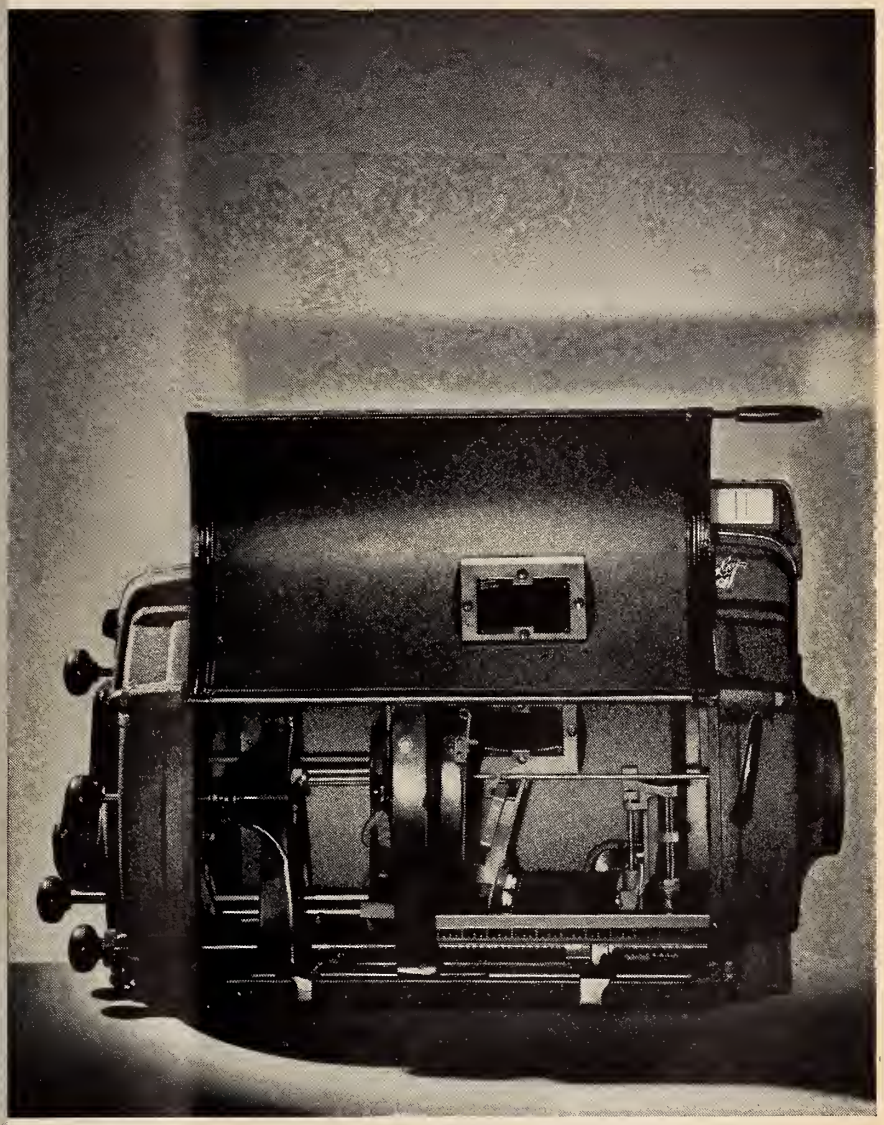
Simplex HIGH

Projection Arc Lamp House

AND ASSOCIATED RECTIFIER EQUIPMENT

A low cost, high intensity, direct current projection arc of intermediate capacity designed especially for theatres of up to 800 seats and using screens as large as 18 feet in width, heretofore restricted to the use of low intensity lamps, with their dim yellow light, because the operating, if not the original cost of the earlier high intensities has been prohibitive.

Although the Simplex High projects twice as much light as the low intensity the over-all operating costs are only slightly higher, because, this new arc operates at only 27 volts as compared to 55 volts in the low intensity, and each 14-inch 7 m.m. suprex positive carbon burns for at least two hours.



THIS *Simplex High* projects the snow-white light characteristic of the high-intensity arc which is so necessary to the projection of colored pictures.

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Branches in Principal Cities

ANOTHER EXAMPLE OF *Simplex* ENGINEERING EXCELLENCE

Technical Requisites for Commercial Television

By *JAMES FRANK, Jr.*

Commercial television can not be introduced with any hope of success in the absence of technical standards for the art; while the opposing viewpoint holds that standards should not be set at present but should be the product of long-term experience with diversified program material. What some of these technical requisites of the art are is detailed in the accompanying article.

THERE are many requirements of a technical nature which must be satisfied before television can occupy its destined place in the electronic arts. A proper appreciation of the present status of the art, what obstacles have had to be overcome and how television really is possible, requires an analysis of the more important of these requirements.

As in motion pictures, the degree of technical perfection of the reproduced image may be measured in part by the detail it contains. To produce a system that will transmit and reproduce pictures of acceptable detail has been one of the most severe problems in the development of television.

The amount of detail that can be transmitted by a television system depends upon the number of picture elements resulting from the scanning process. The number of picture elements, in turn, depends upon the number of horizontal lines by which a complete picture is scanned. A picture element is substantially round and has a diameter equal to the distance between the centers of adjacent scanning lines—that is, the scanning line pitch. As a yardstick in determining comparative definition, it is interesting to note that photographs reproduced in the better newspapers are made up of approximately 4000 picture elements per square inch. Rotogravure pictures of excellent quality may have as many as 10,000 picture elements per sq. in.

● The Scanning Rate

As mentioned previously, there must always be a compromise between picture definition and equipment facilities. During the experimental stages of television, the number of scanning lines (horizontal) per picture has been gradually increased as the apparatus was perfected. Figure 1 illustrates the improvement in detail for a picture of a baseball game with 60, 120, 180, and 240 scanning lines compared with an enlargement of the original. These are synthetic representations developed in the course of studies of the subject. Present standards involve a 441-line picture which produces pictures with detail approximately equal in quality to that obtained with 16-mm. motion picture film. A photograph of an actual 441-line television picture is shown in Figure 2.

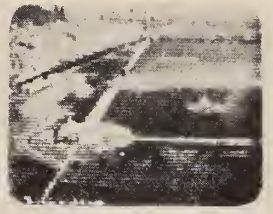
In television, as in motion pictures, two considerations are involved in determining the rate at which the scanning operation must be repeated. The rate of repetition must be great enough to give the appearance of reasonably continuous and natural motion in the reproduced scene, and must be great enough to minimize unsteadiness or flicker in the reproduced picture. Continuity of motion may be maintained with a repetition rate of 16 pictures or frames per second. At least 48 frames per second are required, however, to minimize flicker—unless some artifice be employed.

Persistence of vision is that characteristic of the human eye which causes a retinal image to remain for a short period of time after the actual image focused on the retina of the eye is changed. In other words, the human eye reacts comparatively slowly, so that if the images on the retina be changed with sufficient rapidity, an impression of continuously moving pictures is created.

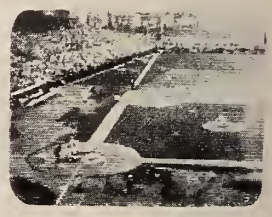
Motion pictures are projected at the rate of 24 frames per second, and the artifice to reduce flicker, and also to solve certain mechanical problems, takes the form of an additional blade upon the projector shutter that interrupts the light while the film is being moved, or while one picture is being pulled down and the next one moved into place for projection. Thus, as far as flicker is concerned, the projection is in effect at the rate of 48 frames per second, each still picture upon the film being projected twice. The light is cut off twice by the two-blade shut-

FIGURE 1

Photos having lines and detail structure equivalent to television images, showing by comparison the increased clearness resulting from increasing the number of scanning lines. These are not photos of actual television images, but are television image equivalents. The caption "Enlargement" is the actual enlargement of the film negative from which the accompanying illustrations with the various line structure were produced.



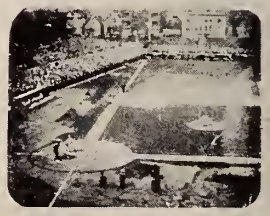
60 Scanning Lines



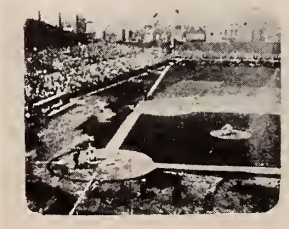
120 Scanning Lines



180 Scanning Lines



240 Scanning Lines



Enlargement

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for general studio use

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for backgrounds and general exterior work

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Des Moines Theatre Supply Co.
National Theatre Supply Co.
Service Theatre Supply Co.

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Southwest Theatre Equipment Co.

LOUISVILLE, KENTUCKY
Beeler Theatre Equip. Co.
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MINNEAPOLIS, MINN.
Elliott Film Co.
Frosch Theatre Supply Co.
National Theatre Supply Co.

ST. LOUIS, MISSOURI
Exhibitors Supply Co.
National Theatre Supply Co.
Rocktein Company

KANSAS CITY, MISSOURI
National Theatre Supply Co.
Stebbins Theatre Equipment Co.

OMAHA, NEBRASKA
Quality Theatre Supply Co.
Scott-Ballantyne Co.
Western Theatre Supply Co.

OGALLALA, NEBRASKA
S. O. F. Corporation

ALBANY, NEW YORK
Empire Theatre Supply Co.
National Theatre Supply Co.

AUBURN, NEW YORK
Auburn Theatre Equipment Co.

BUFFALO, NEW YORK
National Theatre Supply Co.
United Projector & Film Co.

NEW YORK, N. Y.
Amusement Supply Co.
Capitol M. P. Supply Co.
Crown M. P. Supply Co.
Maritime Theatre Supply Co.
National Theatre Supply Co.

CHARLOTTE, N. C.
Bryant Theatre Supply Co.
National Theatre Supply Co.

GREENSBORO, N. C.
Standard Theatre Supply Co.

AKRON, OHIO
Akron Theatre Supply Co.

BELLAIRE, OHIO
Standard Theatre Supply Co.

CINCINNATI, OHIO
Mid-West Theatre Supply Co.
National Theatre Supply Co.

CLEVELAND, OHIO
Oliver Theatre Supply Co.
National Theatre Supply Co.

COLUMBUS, OHIO
American Theatre Equipment Co.

TOLEDO, OHIO
American Theatre Supply Co.

OKLAHOMA CITY, OKLA.
National Theatre Supply Co.

PORTLAND, OREGON
B. F. Shearer Co.
Western Theatre Equipment Co.

EASTON, PENNA.
Easton Sporting Goods Co.

PHILADELPHIA, PENNA.
National Theatre Supply Co.

PITTSBURG, PENNA.
National Theatre Supply Co.
Alvin Seiler
Superior M. P. Supply Co.

MANILA, P. I.
Sound Projection Co.

MEMPHIS, TENN.
Monarch Theatre Supply Co.
National Theatre Supply Co.

NASHVILLE, TENN.
Southern Theatre Supply Co.

DALLAS, TEXAS
Hardin Theatre Supply Co.
National Theatre Supply Co.

HOUSTON, TEXAS
Southwestern Theatre Equipment Co.

SALT LAKE CITY, UTAH
Inter-Mountain Theatre Supply Co.
National Theatre Supply Co.
Service Theatre Supply Co.

SEATTLE, WASHINGTON
National Theatre Supply Co.
B. F. Shearer Co.

SPOKANE, WASHINGTON
Smith Theatre Supply Co.
Theatre Supply & Service Co.

CHARLESTON, W. VA.
Charleston Theatre Supply Co.

RICHMOND, VIRGINIA
W. C. Cottrell

MILWAUKEE, WISC.
National Theatre Supply Co.

IN CANADA

Dominion Sound Equipments, Ltd., Montreal and Toronto
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SO SENSATIONAL has been the progress and so widespread the acceptance of FILM-WELD that now, only six months after its introduction, 85 dealers serve the motion picture industry with this modern film-splicing medium. This record of blanket coverage—made possible by the enthusiastic approval of film technicians—has never been equalled in this field.

And why not? FILM-WELD performance is more than sustaining every one of the following claims made for it:

- *Will not thicken, spoil or discolor.*
- *Retains its full strength to the last drop—even when left uncovered. Requires no thinning agent.*
- *Firmly binds all film—nitrate and acetate, black-and-white and color stock.*
- *Goes twice as far as ordinary film cement—naturally.*

Projectionists are weary of sticky film cement that hardens, that requires thinner and makes a bumpy patch that not infrequently comes apart, particularly on pre-release treated prints. That's why they welcome FILM-WELD, the modern binding agent that looks and flows like water but which binds film instantaneously and permanently.

The dealers listed on this page handle and endorse FILM-WELD because they believe in progress and are anxious to serve you better. Patronize them not only for FILM-WELD but for the best in projection supplies. Remember—FILM-WELD is the only film binder that is sold on a money-back-if-not-satisfied basis.

LARRY STRONG, INC.
1241 South Wabash Avenue
Chicago Illinois

ter, once while the film is moving and once while it is standing still.

Such an artifice is not applicable in television. Some other method must be devised. Interlaced scanning is employed to provide satisfactory freedom from flicker. In this procedure, instead of scanning the picture in adjacent lines from top to bottom, alternate lines or every other line, covering the entire area of the picture are first scanned, and then the beam returns and scans the omitted lines. The *entire picture* is scanned 30 times per second, but the *picture area* is covered in *alternate lines* 60 times per second. This arrangement is most desirable to eliminate flicker because it permits pick-up from motion picture film which must be run at the standard rate of speed to permit suitable reproduction of a standard sound track.

● Power Supply Data

Another requirement in television is the relation that should exist between the frequency of the power supply to both transmitter and receiver and the repetition rate. It is desirable that the repetition rate be an integral divisor or multiple or sub-multiple of the power line frequency. This is necessary in order to minimize certain non-synchronous interference effects, which otherwise might be detrimental to the picture.

Television transmitters and receivers are designed to operate in this country on a 60-cycle a.c. power supply, this a repetition rate of 30 frames per second fulfills the requirement, whereas 24 frames per second would not. This is the smallest sub-multiple of 60 the double of which is above the maximum flicker frequency observable by the eye.

The transmission electrically of high-definition images over a single channel, cable or radio, requires very wide frequency band apparatus and circuits. This is occasioned by the rate at which information must be transmitted relating to the brightness of a very large number of picture elements.

For example, a 390-line picture with an aspect ratio (the relationship of the length to height) of 4 to 3 will contain 202,800 picture elements. This figure is derived from the product of the square of the number of scanning lines and the aspect ratio (390 x 390 x 4/3). When 30 pictures per second are thus scanned, information must be transmitted concerning the brightness of 30 times 202,800, or 6,084,000 picture elements each second. One cycle of the picture signal provides such information for two picture elements in interlaced scanning, so that 3,042,000 elements per second must be transmitted. The total frequency band required for transmitting a picture as above described is about 4,000,000 cycles per second, or 4 megacycles per second.



FIGURE 2

Image of Betty Goodwin, NBC television announcer, drawn on 441-line

As a means of comparison, ordinary high quality speech transmission involves apparatus and circuits to accommodate a frequency band of not to exceed 10,000 cycles per second.

Four megacycles per second is the width of the frequency band, to accommodate the highest frequency television signal, that must be amplified and carried by the apparatus and circuits in the television system. It is the frequency band by which the carrier-wave or antenna current of the radio transmitter must be modulated. The total radio transmitting channel will be 8 megacycles per second when the carrier is modulated by the picture signal, 4 megacycles per second about the carrier and the same number below. This is equal to the combined widths of 800 sound broadcasting channels of 10,000 cycles each!

Channels of such great width are not available in the frequency spectrum or range now used for radio services. For this and other reasons related to technical requirements, the ultra-high frequencies, or ultra-short waves, are used for television. Frequencies above 30 megacycles, equivalent to below 10 meters since cycles times meters always equals 300,000,000, are employed.

Ultra-short waves have properties in propagation similar to optical waves. The range over which satisfactory high definition television pictures may be reliably transmitted by ultra-short waves is limited practically to the distance of the horizon from the height at which the transmitting antenna is placed. Under some abnormal conditions, pictures may be received over greater distances for periods of very short duration, but primarily television stations will serve local areas. The signals from the stations in these local areas will be stable and will have about the same intensity during the day and night hours and during all seasons of the year.

● Short Wave Action

The explanation of this relatively short distance of satisfactory transmission is that these very short radio waves are not reflected by the Heaviside layer. The Heaviside layer is a layer of air, filled with electrons and ionized gas molecules, which acts like a good reflector for electromagnetic radio waves. It is located about 100 miles from the earth's surface and its height changes with sunlight conditions. It is higher at night than in the day time.

Radio waves of the order of the regular broadcast band (550 to 1600 kilocycles per second) are reflected and may thus be transmitted over long distances, being reflected from the Heaviside layer to the earth and back a number of times. Television waves are not reflected by the Heaviside layer, so that only the direct waves are useful.

In order to economize on the use of the frequency band required, "vestigial side band" transmission is used. In this system, the partial elimination of one side band is achieved by the use of bandpass filters which have a range of partial transmission in the region on either side of the transmission band.

To explain vestigial side band transmission it should be recognized that one side band by itself carries all the characteristics of the signal; no more intelligence is carried by the other band but simply more power. Thus, if advisable, we may partially eliminate one

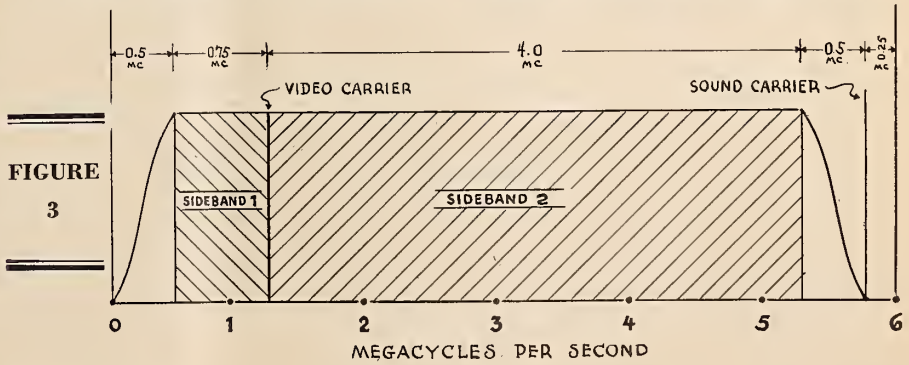


FIGURE 3

side band, leaving enough of it to avoid certain distortions. This is called "vestigial side band" transmission and has the advantage that the width of the frequency band required for the channel may be decreased to five-eighths approximately that required by the ordinary double side band method.

In transmitting television programs, it has been found desirable to transmit the picture and sound in the same channel. This allows a single oscillator to be used for both sight and sound in a superheterodyne television receiver, thus greatly simplifying tuning. In this system, the sight and sound signals are separated by selective circuits in the intermediate frequency amplifiers.

It is well to again emphasize the necessity for considering the television receiver as an integral part of an entire system. This is in contrast to sound broadcasting. Television receivers must be designed for transmitters which operate on well-defined standards. If changes are made in these standards, all television receivers might become obsolete. This is one important reason why so much time and money have so far been spent to develop television to a practical commercial stage before its introduction.

Some Tele Standards

Some of the more important standards which have already been agreed upon after so much experimentation are of interest:

Television Channel Width: The standard television channel shall not be less than 6 megacycles in width.

Television and Sound Carrier Spacing: It shall be standard to separate the picture and sound carriers by approximately 4.5 megacycles.

Sound Carrier and Television Carrier Relation: It shall be standard in a television channel to place the sound carrier at a higher frequency than the television carrier.

Position of Sound Carrier: It shall be standard to locate the sound carrier for a television channel 0.25 megacycles lower than the upper frequency limit of the channel.

Another standard which has been adopted is as follows:

It shall be standard in television transmission that black shall be represented by a definite carrier level independent of light and shade in the picture.

This means that the background level is transmitted in a television signal, thereby eliminating the need for readjustment of the receiver when the scene being televised changes from a preponderance of white to a preponderance of black.

It shall be standard for a decrease in initial light intensity to cause an increase in the radiated power.

In order to prevent the possibility of the picture tube at the receiver showing the equivalent of a photographic negative it is necessary to standardize on the polarity of transmission. Negative polarity has been agreed upon. Unless the receiver is designed for this polarity from the transmitter, the synchronizing signals would not be effective.

Figure 3 is a diagram of how the 6-megacycle television channel is divided up. It shows the location of both the picture or video carrier and the sound carrier, and indicates the whole and partial side bands.

It can thus be recognized that many standards have had to be agreed upon by all manufacturers of transmitters and receivers before it is possible to introduce television commercially.

Exceed 'Visual Horizon' Making Tele Network Possible

TELEVISION, limited hitherto to a range of about fifty miles (the so-called "visual horizon") is ready now for public operation over networks covering a much greater area, RCA announced recently. Development of the radio-relay method of transmitting makes it possible for a station in N. Y. City, for example, to reach receivers in cities as far distant as Boston and Washington, the announcement said.

This, it was declared, clears away a principal technical difficulty which hitherto had obstructed the development of television broadcasts. Application has been made to the F.T.C. for a revision of the rule which forbids commercial sponsorship of programs, it was learned, although the formal announcement did not say this.

Want Sponsor Ban Lifted

Should the rule on sponsorship be relaxed, development of the network probably will go forward, it was understood. No date for this extension was indicated, however.

A New York network capable of reaching Boston and Washington, in spite of its seemingly limited scope, would make television available to about 20,000,000 persons. Programs would not be confined to N. Y. but might originate at any station forming part of the network in that area.

Similar networks, it was explained, could extend television to other parts of the country, making the broadcasting of programs possible on a nation-wide scale. The announcement was based on evidence obtained in nine months of operation of a regular television program service in the N. Y. metropolitan area.

The relay system, which differs from other methods of radio relay in that it makes use of specially designed relay stations operating on frequencies many times higher than those of the regular television broadcasting stations, has been tested also.

Result of Year-Long Tests

The tests in this respect were carried out for nearly a year between the N.B.C. transmitter in the Empire State Building, and Riverhead, L. I. Relay stations in these tests were at Hauppague, 45 miles from the transmitter and at Rocky Point, 15 miles from Hauppague and the same distance from Riverhead.

67 SPONSORS FEATURE TELE SKED OVER 8 MONTHS

NBC announces that during the past eight months 67 different advertisers sponsored a total of 148 programs over W2XBS, video station. Total hours per month devoted to advertisers rose from 6.5 hours to 11.4 in December.

There are 2000 tele receivers in N. Y. area, asserts NBC, with 89.8 per cent in homes and the rest spotted in theatre lobbies, hotels, stores and other public places. Average evening audience is 8,000. Average for both day and night is 68.9 per cent of total potential audience, a good index of tele's appeal.

Television Standards Muddle Is 'Poison' for Broadcasters

Current uncertainty over television standards is imperiling the television broadcaster, Paul W. Kester, vice-president of C.B.S. told the F.C.C. at recent tele hearings.

Networks are apprehensive that a change in standards would produce a "complete obsoleteness" of sets in the hands of the public and would arouse a resentment which would be directed, not at the manufacturers, but at the broadcasters.

The CBS officer said that when his company begins picture broadcasting in New York, the mere fact that two stations are providing programs will be an important factor in creating a market for receivers, and estimated that 10,000 to 15,000 sets would be sold in the first year and from 30,000 to 40,000 within two years.

Wary of Set Obsolescence

Any change in standards which will render those sets obsolete or necessitate expensive conversions, he declared, would threaten a public investment of millions of dollars. The resulting resentment would be directed at broadcasters, and where stations were engaged in both regular and television transmission, the effect might be very serious, Kester said.

Taking the position that recommendations of the F.C.C. television committee, offered an inconsistency because broadcasters are urged not to take steps that will create an immediate heavy demand for sets while at the same time initiation of regular program service is encouraged, Kester suggested three possible means of dealing with the situation.

His suggestions were (1) That the Commission fix present standards for a specified period of years and allow broadcasters to proceed with their program efforts, (2) Delay both the "freezing" of standards and the launching of new programs until standards can be developed which will not render sets obsolete, or (3) Proceed immediately with scheduled programs and with trying to fix new standards, until standards can be guaranteed for a definite period of years.

Projectory Layout and Maintenance

A REPORT OF THE PROJECTION PRACTICE COMMITTEE OF THE S. M. P. E.†

DURING the past year, the Committee has undertaken and successfully brought to fruition several major projects of oustanding importance to the technologic groups of the motion picture industry. Moreover, the Committee is gratified to note that its recommendations to the industry have been widely accepted and put into general practice. Indeed the principal purpose of the Committee is to investigate any problem of projection that may be facing the industry, to determine the existing circumstances, and to recommend any alterations in these circumstances that may be dictated by the needs of good projection.

Perhaps one of the most important of the projects that has been undertaken by the Committee is the revision of the earlier projection room plans. The first set of projection room plans was drawn up in 1930, and since that time the many advances in the art of projection and in the projection equipment have made it necessary to revise the plans.

Naturally, the establishment of a set of plans aiming toward a high level of projection, operation, maintenance, and safety would lead toward a thorough investigation of projection room design from the point of view of fire prevention and control. These plans and survey have been published in *The Architecture Record*, thus bringing them to the attention of architects of the country and so contributing toward improvement in theatre design.

There has also been a comprehensive revision of the "Regulations for Handling Nitrocellulose Motion Picture Film" of the National Fire Protection Association, the original edition of which was brought out in 1931. Obviously, in view of the marked advances in the art since 1931 these regulations required thorough revision.

● NFPA Revised Code

After study of the proposed revision, by the Committee on Hazardous Chemicals and Explosives of the NFPA, the revision was voted upon at the May, 1939, meeting of the NFPA at Chicago and was adopted practically without change. A few additional points not covered in the present revision still remain, but these features will be taken under advisement by the Projection Practice Committee during the coming season. The NFPA has recently issued a revised booklet of regulations, which may be obtained upon request to them.

An account of the work of the Committee during the past year, in which is traced the evolution of the SMPE Projection Room plans and their general adoption by the industry. Work is being initiated by the Sub-Committee on Theatre Structures in a study of the disparity that exists among various State and municipal motion picture regulations. The subject of heating projection rooms is also reported upon by the Sub-Committee on Fire Hazards.

Work has been begun by the Sub-Committee on Power Survey in determining the average or representative operating conditions, with particular respect to the power consumed, in theatres of various seating capacities and equipped with various types of projection apparatus.

The revision of the regulations was based in large part upon the great improvement that has occurred during recent years in the construction of motion picture projection rooms—and this improvement, the Committee feels, is largely due to the Projection Room Plans originally issued in 1930 and periodically brought up to date. One of the most interesting results of this work was a recent ruling in the State of Connecticut with regard to the use of sprinklers in motion picture projection rooms. The SMPE projection room plans form the basis of the Connecticut State Regulations, and, in turn, the New England Fire Insurance Rating Association has ruled that in motion picture projection rooms, constructed and protected in accordance with the requirements of the State of Connecticut, automatic sprinkler protection may be omitted from the projection room. It is further recommended by the New England FIRA that the soda-and-acid chemical extinguishers be placed immediately outside the projection room rather than inside.

It has long been the opinion of the Committee that automatic sprinklers might well be omitted from projection rooms in view of the high speed with which film burns and the great damage done to the sound and projection equipment when the automatic sprinkler valves are released. A reel of film set on fire will often burn itself out before the sprinklers have had a chance to operate; then afterward the heat of the room may release the sprinklers.

In projection rooms designed in accordance with the SMPE plans and the requirements of the State of Connecticut, the chances of fire in such projection rooms are very much lessened, and, in addition, the transmission of the fire beyond the confines of the projection room so constructed is practically negigible. It is on these bases that the State of Connecticut and the Committee recommend that sprinklers be omitted, and it is a source of satisfaction to the Committee to be able to trace this evolution of practice back to its original SMPE Projection Plans.

● Motion Picture Codes

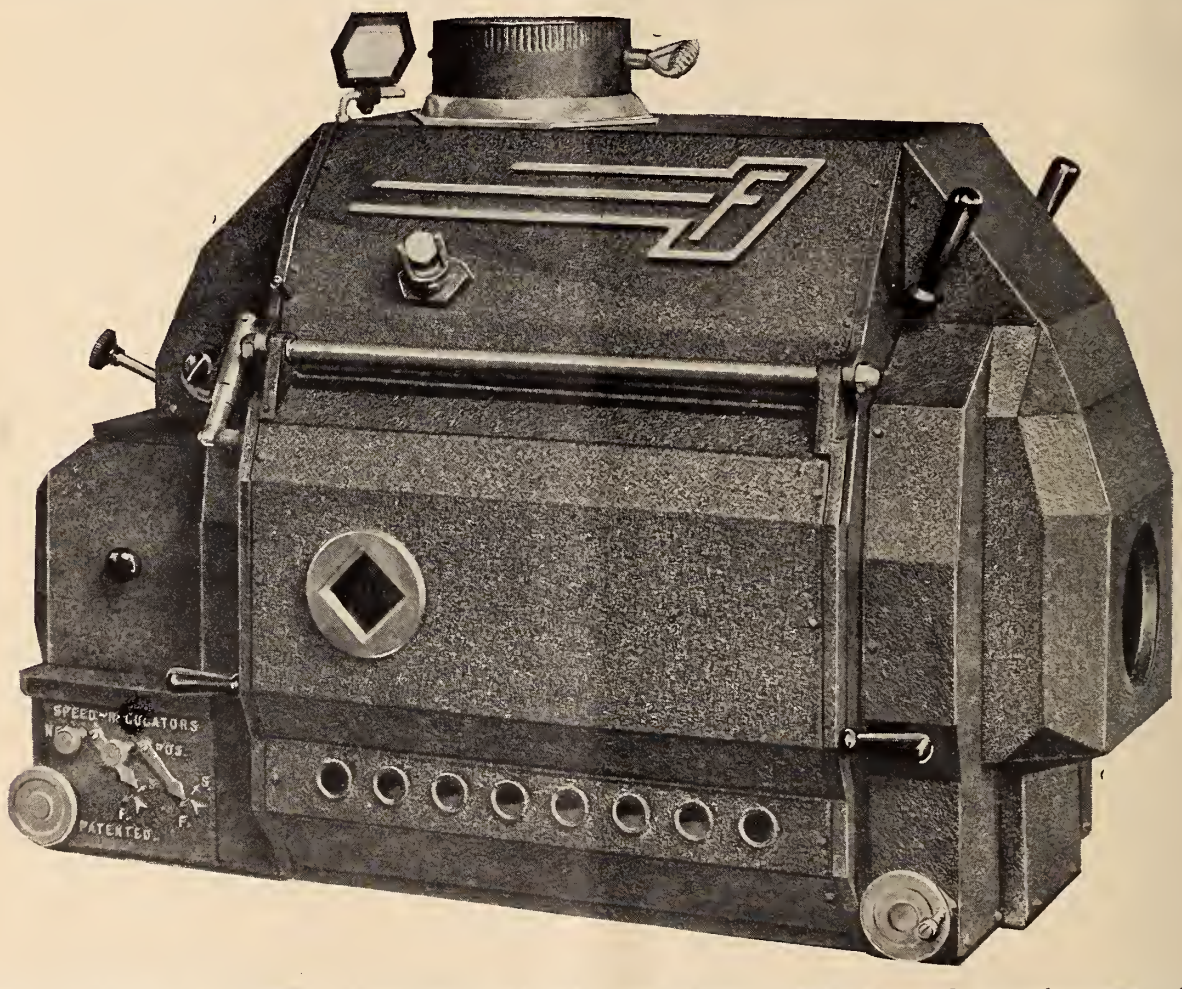
One of the most troublesome features of projection room design, construction, and installation of equipment is the great disparity that exists among various state and municipal motion picture regulations. The extent to which these various codes differ and conflict has been very forcibly shown by the Board of Labor statistics of the United States Department of Labor in a publication which dealt specifically with "Safety Standards for Motion Picture Machine Operators."[1]

It is not necessary at this point to go into these differences; however, it is well known that such disagreement and conflict among the codes of the states and municipalities exist not only with respect to projection rooms but also in relation to theatre structure and auditorium conditions. The Sub-Committee on Theatre Structures has been engaged in studying these problems, the latter subject, namely, auditorium conditions, including both lighting and acoustic treatments, as well as other

† J. Soc. Mot. Pict. Eng. Feb. 1940, p. 125.

[1] I.P. for March, 1938, p. 27.

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OTHER LAMPS CLAI



FOREST, for more than a quarter of a century, have been the leading designers and manufacturers of power conversion equipment. NOW, WE ANNOUNCE TO THE INDUSTRY an improved projection lamp engineered and developed by Forest to overcome the technical faults in present lamps.

The introduction of the Forest "Universal Trim" Projection Lamp to the industry assures to every Projectionist that top efficiency demands have been met. The wide technical scope covered by this New "UNIVERSAL TRIM" Arc Lamp by Forest . . . DOES WHAT ALL OTHER LAMPS CLAIM TO DO—COMBINED.

Consult FOREST before purchasing Simplified High-Intensity, Suprex, A.C. or Low-Intensity equipment . . . ONE FOREST LAMP COVERS THEM ALL.

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A REVOLUTIONARY ENGINEERING ACHIEVEMENT

"UNIVERSAL TRIM" —Forest projection arc lamps take any type of carbon trim . . . from 5 to 9mm. negative, 6 to 13mm. positive—thus accommodating trims for Suprex or Simplified High-Intensity, Low-Intensity and all new requirements including the trim, first announced by Forest to the industry on October 19th, 1939. This trim replaces Low-Intensity, giving intense white light at lower operating cost. This new D.C. lamp can be operated from 30 to 65 amperes. Whether your picture is black-and-white or in color, you are guaranteed a perfect source of white light.

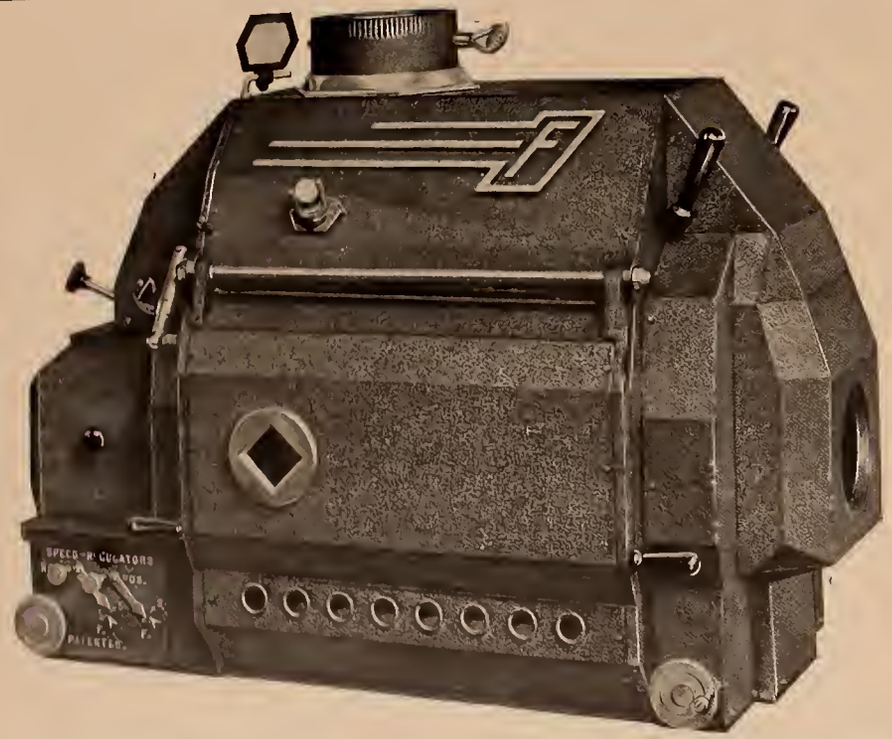
And these features . . . . . .

- Completely new PATENTED arc feed.
- An entirely new carbon feed which maintains perfect focus. Does not require constant attention.
- The feeding speed of any type positive carbon can be adjusted accurately without in any way affecting the feeding speed of any type negative carbon, allowing independent accurate adjustment of each, thus keeping the arc in exact focus with the optical system at all times.
- Lamp will burn any Low-Intensity trim or any Simplified High-Intensity trim without change of carbon holders. Thus the "UNIVERSAL TRIM" Lamp.
- Electro-magnet placed at side of mirror with adjustable arm allowing magnetic influence to be adjusted to compensate for draft and other operating conditions, which vary in different theatres.
- Reflector mirror by Bausch & Lomb, guarantees perfect and lasting screen illumination.
- Reflector can be adjusted or tilted in any direction and in addition can be adjusted backward and forward for obtaining sharp accurate focus while lamp is operating, this insures maximum illumination obtainable.
- This lamp is designed to take larger mirror for faster lenses when they are obtainable.

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factors related to the viewing and hearing of motion picture productions.

The first step in the work is to obtain copies of the codes of all the states and important municipalities. When these codes have been received they will be compared and analyzed in the hope that ultimately a representative code might be drawn up for submission to the various states and municipalities, with the view of fostering uniformity in their regulations. This is admittedly an ambitious program. However, at least one state, namely, Connecticut, is already working closely with the Committee, and the influence of the Committee's work is being felt throughout the country by virtue of its recent recommendations toward revision of the NFPA regulations, so it is hoped that other states may be induced to join the work.

● Heating Hazards Rife

Following naturally upon the aforementioned projects comes the problem of heating the projection room. Information has come to the Sub-Committee that hazardous practices are found in the industry with regard to heating projection rooms. Instances have been cited wherein open-flame gas heaters have been used.

The subject of heating projection rooms has already been covered in the SMPE Plans wherein it is stated that "proper provision shall be made for heating projection rooms. The same facilities used for heating the theatre should be extended to the projection room."

The regulations of the NFPA for handling nitrocelluose motion picture film state that "artificial heating in any building or room other than a vault in which motion picture film is used, handled or stored, shall be restricted to steam. . . . Heat-generating apparatus shall be in a separate room. . . . Ordinary hot-air furnaces are prohibited. Gas, oil, and electric heaters are prohibited in rooms where film is handled or stored."

● Room Heating Problem

The problem of heating projection rooms may be approached from two points of view: the ideal or the immediately practical. Writing regulations into the SMPE Plans which aim toward the ideal would lead to connecting the projection room to a central heating plant. In instances where this is not convenient, economic, or practicable, provision for local and separate heating of some projection rooms may have to be made. Even when a central heating plant is used, the projection room may require heating before the show to assure fluidity of the oil and grease in the projector and to make the projection room temperature bearable for the projectionist, especially when the projection room is located on an outside wall of the building in an exposed situation.

This Committee definitely does not recommend the use of gas or oil for any individual heating unit located inside the projection room. This does not mean that gas may not be used for central heating plants using steam, hot water, or hot air, or for any auxiliary heating system in which the heating element is remote from the projection room. This report is not

(*Continued on page* 29)

New Cyclex Transformer Design

AN entirely new transformer design for the Cyclex projection equipment manufactured by C. S. Ashcraft Co. has been announced. Formerly it was necessary to heat the incoming arc on 60-cycle current, while the arc projecting the picture was operating from the frequency changer. With the new transformer design, both arcs may be operated simultaneously from the frequency changer. This eliminates the necessity of the relay for switching the current from 60 to 96 cycles and simplifies installation and operation.

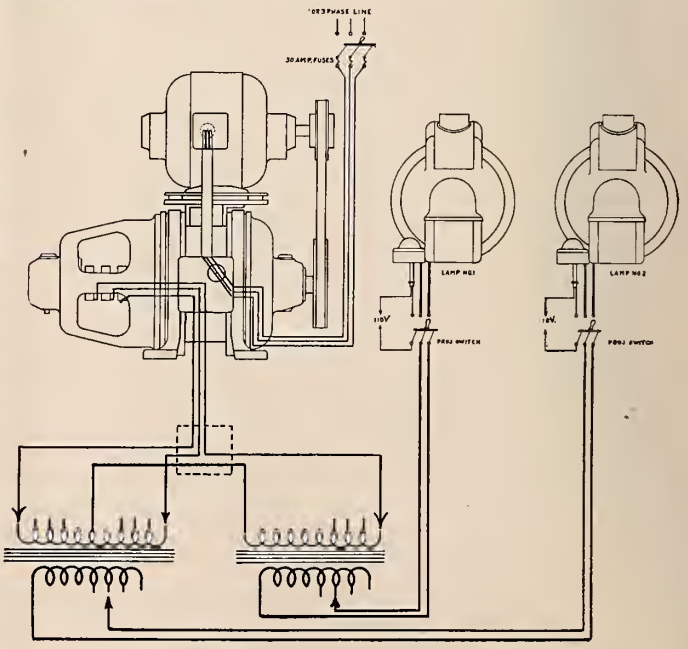
The same power unit, consisting of a rotary transformer and ¾ H.P. driving motor, is used and there is no drop in voltage when the second arc is established. In fact, both arcs may be operated for periods of from 4 to 5 hours at a time without excessive heating of the power unit. The transformer is so designed that while one arc is operating, the secondary leads on the other transformer may be short-circuited continuously with no damage to the transformer and no effect upon the arc which is burning.

● Design, Operating Data

This new transformer design (see illustration) utilizes all three phases of the power delivered by the rotor of the frequency changer. This current is fed into the primary of a Scott-connected transformer, this three-phase current, of course, being transformed to two-phase current with this type of transformer. One arc is operated from each of the two secondaries. Whereas previously the arc no-load voltage was approximately 24 this has been increased to approximately 35 volts, with the full-load voltage—that is, the voltage while the arc is burning, being approximately 20. This results in a very resilient arc which may be lengthened, if desired, to a full ¾ inch before it will extinguish itself. However, the normal arc length is approximately 3/16 inch.

The wiring for the new transformer system is very simple—in fact, one transformer may be located beneath each projector. The three small wires are carried to the transformers, eliminating long heavy arc current leads. The new method of utilizing the current from the converter simplifies installation and operation and increases the light output for the power employed.

Recent installations, the manufacturer reports, have shown that for a power input of approximately 2 kw. a light output of 3900 lumens, without the shutter operating, has been obtained. The amount of light, of course, is determined largely by the effective focus of the lens and the speed. In the instance cited, a lens of f/2.4 was used. This indicates that Cyclex is now being operated in the lower Suprex range.



Wiring diagram of new Cyclex system, showing new transformer design

Portable Emergency Sound System

By *G. F. HOLLY*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

EVERY projectionist has at one time or another been faced by emergency situations in which his own ingenunity and knowledge of his equipment has kept the show running. No doubt many projectionists recall some of the incidents in their experience when ingenious and sometimes humorous expedients were employed to keep equipment operating. A bucket of salt water temporarily replaced a rheostat; a hot generator bearing was cooled with a bellows or bicycle pump; a.c. was used on the arc when the generator failed, and numerous other emergency expedients.

Similarly, many ingenious methods have been evolved to cope with the more complex problem of sound difficulties and outages, the causes of which are almost innumerable. Projectionists have strapped out filter capacitors which failed, paralleled soundheads, jumped faders, used their automobile battery for exciter supply, jiggled switches and pounded on amplifier racks to keep the system operating, pending the arrival of the sound service engineer.

● Emergency Set Content

Often projectionists were left helpless with a dead voltage amplifier, or all speaker voice coils blown by the earthquake scene or various other major units "out," which require several hours time to find the trouble, obtain replacement parts, and repairs.

A need has always existed since the advent of sound for an emergency sound system, which would be complete from phototubes to loudspeakers. This need was given serious consideration by the RCA Service Division, which developed and made available the first complete portable emergency system in May, 1937. This unit is known as the type PG-109 Emergency System. Through its use all essential electrical units of any sound system can be quickly replaced, and as long as the projector and soundhead will run, sound continuity is assured.

The emergency system consists of an amplifier the power output of which is capable of handling any average size house. It is equipped with all necessary cords, plugs and clips to facilitate quick connections. Two permanent magnet dynamic loudspeakers are mounted in a suitable carrying case which also serves as a baffle when the speakers are in use. Two exciter lamp transformers are supplied. Fading is accomplished by means of a sound-changeover switch mounted in the amplifier case. An equalizing potentiometer is provided to balance outputs of the two soundheads, as well as a special input jack for microphone or phonograph.

In use the amplifier unit is generally placed between the two soundheads (see Fig. 1). Two low-capacity cables permanently connected to the amplifier at one end and equipped with phototube adaptors at the other end are plugged into the soundhead phototube brackets on standard type soundheads. For older type soundheads an adaptor equipped with short leads and clips is utilized. The phototube signal, as well as the polarizing potential is carried by these low-capacity cables.

In the event the stage speakers are known to be operable, the amplifier output cable can be clipped onto the stage wires after they have been disconnected from the main system. The output control switch is then set to the proper tap to match he existing stage speaker impedance. Taps are provided for 4, 7½, 15 or 250 ohms impedance. Should trouble exist in the stage speakers, the emergency speakers are placed one at each side of the screen on the stage floor. Cables can be clipped on to the existing stage run or to a spare pair of wires that may be available.

No field supply is necessary when the emergency system speakers are used; however, facilities are provided in the amplifier to furnish 100 volts at 100 mils. for one speaker field, or

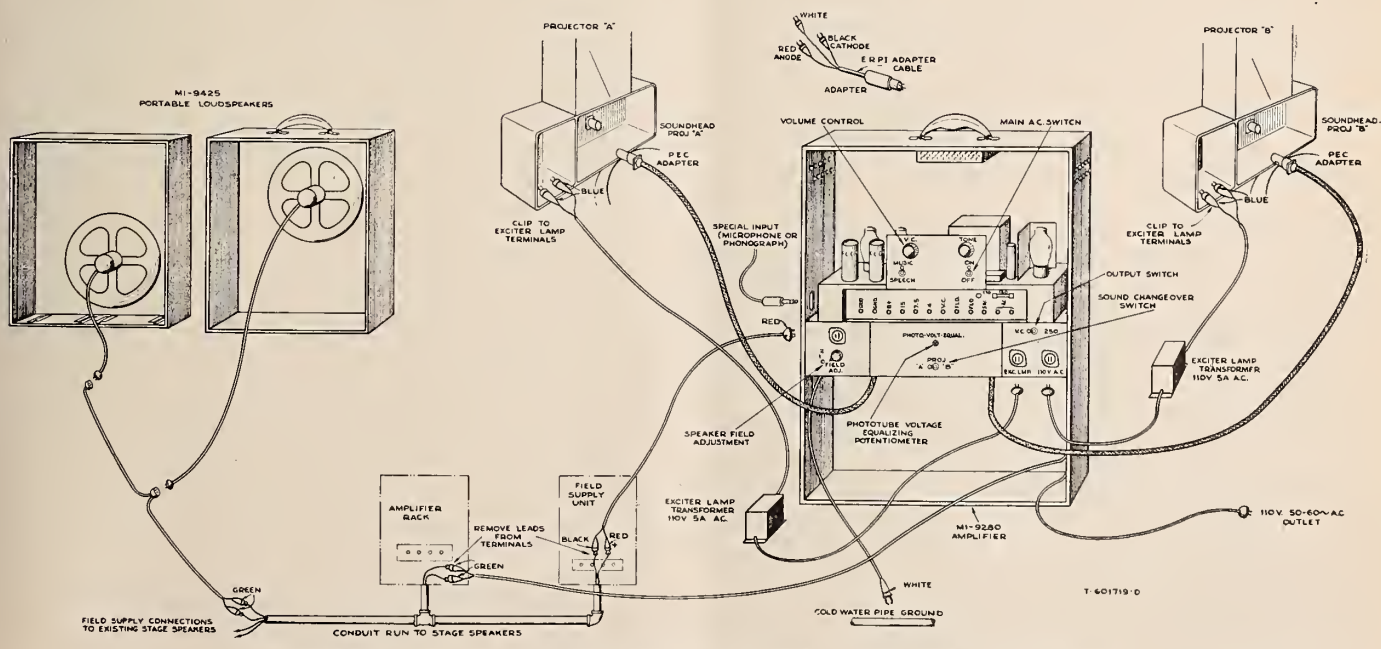


FIGURE I. *The RCA portable emergency sound system set up for operation*

for two 100-volt, 100-mil. fields when they are connected in series. A field-adjusting switch is included marked "0, 1 & 2" to handle any of the three uses, respectively. After the amplifier is set up, the a.c. power supply cord is plugged in and the amplifier is turned on by a conventional "on-off" switch. A tapped power transformer permits accommodation of the system to various line voltages.

● Separate Lamp Supply

The two emergency exciter lamp transformers supply 5 amperes at 10 volts a.c. Suitable cords plug into the amplifier case receptacles supplying 110 volts a.c., and are controlled by the emergency amplifier switch. The output cord is equipped with insulated clips which are connected to the exciter lamp socket terminals after the existing leads have been disconnected. This arrangement provides for an independent supply for each lamp.

The special input receptacle and jack are designed to accommodate any type of high impedance microphone or phonograph pick-up. By virtue of these facilities the emergency sound system readily adapts itself to being used as an incidental public address system, and, being portable, can be hooked up either in the projection room or on the stage.

● Proves its Worth

On one occasion a 3000-seat theatre with a capacity audience was presenting an outstanding picture. The large modern and powerful sound system was functioning perfectly. A smaller standby channel was always turned on and warmed up, ready to carry on instantly at the throw of a switch, should the main channel fail. Outdoors an electrical storm was at its height. Suddenly a severe surge on the a.c. power line caused an arc to jump across the main system power transformer terminals, carbonizing the bakelite base and causing a complete short-circuit.

The standby channel amplifier lost a filter capacitor and choke coil before the line fuses blew. After replacement of practically all blown fuses in the house, after this sudden pandemonium, all was well in the projection room except "no sound" on either channel. While the theatre manager was having (among other things) visions of refunding 3,000 admissions, one of the projectionists was on his way to another theatre of their circuit a block down the street, to obtain their portable emergency system. In the interim the other projectionist readied the projection room equipment for emergency connections. Four minutes after the portable emergency system arrived, the show went on; the audience cheered, the manager beamed.

On another occasion a theatre lobby fire at night resulted in the amplifier becoming water-soaked, rendering it inoperative. The emergency system case was drenched, too, but it came through unharmed and saved the show.

The unsung victories of this emergency system over odd emergency situations are making it essential projection room equipment, and has won the highly popular regard of projectionists everywhere.

Restriction of Mechanical Devices Causing Unemployment O. K., Says High N. Y. Court in A. F. of M.—I. A. Test Suit

DECISION which the Appellate Division of the New York State Supreme Court handed down recently in favor of the American Federation of Musicians on the right to restrict mechanical devices when they interfere with employment has aroused considerable speculation within the film industry. While the court split three to two on the decision, the finding is regarded as highly significant in that it squarely upholds the right of a labor union to prevent the use of a labor-saving mechanical device even though the union's action results in injury to the exploiter of the device.

The Appellate Division's decision strikes sharply against a statement of legal principles on the same subject which Thurman Arnold, assistant U. S. attorney general, issued last November. Arnold has taken the position that by interfering with technological progress and compelling the employment of unnecessary persons organized labor exposes itself to prosecution under the anti-trust laws.

● I. A. a Co-Defendant

Co-defendant with the A. F. of M. in this important test case was the I.A.T.S.E. Opera-on-Tour, Inc., which brought the suit in Nov. 1938, sought an order directing the two unions to stop interfering with the employment of stagehands by this producing setup because of its use of mechanically reproduced music used as accompaniment to opera singers in place of an orchestra. The requested injunction against the two unions was granted in March, 1939, and it was this restraining order that the Appellate Division vacated last week.

Opera-on-Tour charged the two unions with conspiracy to coerce stagehands not to work after the A. F. of M. had previously condemned the mechanical device as harmful to its members. Also that as a result of the unions' action the project had to fold, and 50 singers and a chorus lost their jobs.

Because of the importance of the

(*Continued on page* 27)



Standout among all the holiday cards received by I. P., from the self-styled 'Hillbilly Local,' of Hemet, Calif.

TELE APPROX. FILM QUALITY, SAYS RCA RESEARCHER

Audiences viewing television on a screen 4½ by 6 feet cannot tell whether they are looking at a film or television, according to E. W. Engstrom, RCA research director.

"People viewing it for the first time, after a moment or two, are quite unconscious of the method of portraying the picture," says Engstrom. "They are not sure whether they are looking at television or whether they are looking at a movie projection. It is so very good."

Engstrom explained that the 4½ by 6 foot screen does not employ a projection principle. The light is "formed directly on the screen by the impingement of the electron stream on the phosphor, just on the inner surface of the tube," he explains.

12′ x 9′ Screen Image Next

Discussing experiments for projected pictures from smaller tubes, Engstrom states that the next step is to produce an image 9 by 12 feet. "We have the development under way now to get apparatus together for testing that particular apparatus," he adds. "That size, of course, is getting into a size that might be useful for large audience viewing, even in theatres."

New B.&L. Coated Lens Process Cuts Reflection and Boosts Light Transmission

By *EVERETT W. MELSON*
BAUSCH & LOMB OPTICAL CO.

IF THE beauty of the motion picture "Gone With the Wind" meets all your expectations and surpasses them a little, it may be that new projection lenses had something to do with it, since the first showings of this picture coincided, most opportunely, with Bausch & Lomb's introduction of its new coated lenses. These lenses improve image contrast and sharpen the focus by cutting down deflection and increasing light transmission.

When tests in Rochester theatres disclosed that screen illumination could be stepped up from 15% to 30%, depending upon the type of projection lens and its focal length, by coating the inner glass-air surfaces, an order came from Lester Isaac, director of sound and projection for Loew's Theatres to equip 25 theatres for the first screen appearances of Scarlett O'Hara and Rhett Butler. Since this picture is in color, the added screen brilliancy is a vital factor in making it a photographic, as well as a dramatic success.

Although this is the first commercial application of the new coating process, its history goes back as far as 1852 to Grove's work on cathodic sputtering of metals in a vacuum, and the more exhaustive investigations of Sir William Crookes in 1891.

● Tarnish Effect Noted

In the following year H. Dennis Taylor, a British lens designer, began to take notice of the effect of films on lenses when some flint elements were returned for repolishing. His tests showed that if a photographic plate were exposed, under identical conditions, through a tarnished and an untarnished lens, more light would reach the plate through the former. He confidently assured owners of tarnished lenses that they were getting increased transparency. Said he:

"Whereas a thin plate of dense flint glass of the type usually used for objectives will, when freshly polished, reflect back from its two surfaces about 11% of the light falling upon it, and transmit 89%, the same plate when tarnished . . . will reflect back only about 5%, and transmit 95%, a perceptible gain of from 5% to 6% in transparency." Taylor, therefore, attempted to tarnish lenses artificially by immersing them in various solutions and found that hydrogen sulphide and alkaline sulphides reduced reflection appreciably.

In 1916, Kollmorgen, "acting upon the hints contained in Taylor's description, experimented a good deal with different chemicals along the same lines and found means of oxidizing most of the glasses used in optical work," according to a paper delivered before the Illuminating Engineering Society.

At about the same time, Dr. Hermann Kellner, who was head of the Scientific Bureau of Bausch & Lomb, was working along similar lines. He mentioned his experiments to Dr. F. E. Wright, while the latter was at the B. & L. plant in 1917 as a member of the group of silicate chemists aiding the Government.

NEWS LENS 'BEST EVER' SAYS LOEW CHIEF

"The new Bausch & Lomb coated lenses, in my opinion, constitute the greatest advance in projection optics since the inception of motion pictures," is the verdict of Lester Isaac, director of visual and sound projection for Loew's Theatres. "These lenses are equally effective with either black-and-white or color prints, but the results obtained with the latter will particularly surprise and delight projectionists."

● Much Recent Progress

Realizing the importance of the matter in the design of military instruments, Dr. Wright began a series of experiments with Dr. J. B. Ferguson. Although these were never concluded, due to the stress of war work, time-temperature relations were worked out for several concentrations for each type of glass. Reflectivity was definitely decreased, and Dr. Wright offered three hypotheses to account for the phenomenon, the most likely one being that in the process of etching by the attacking solution the surface becomes covered with minute pits which are small compared with the wave-length of light.

In 1936 John Strong described a physical method of coating films to produce the same effect as the chemical method. His process involved the evaporation of metallic fluorides in a high vacuum so that the evaporated molecules traveled without intermolecular collisions from a hot metal source to the cold surface of the glass. He described the use of a film of decreasing index of refraction which starts out with the full index next to the glass. This was done by depositing a film of fluorite, solid below and porous above.

Agreeing with the Wright hypothesis, Strong states that "the grain of this porosity is small compared to a wavelength of light as evidenced by the fact that it does not scatter light." With such a film he noted decreases in reflection of from 54% to 85%, depending on the angle of incident light.

Since Strong's work several physicists have used this technique, among them being Cartwright and Turner, who have used various metallic fluorides to produce imperceptible films on glass to increase the transmission of light.

Simultaneously, Dr. Katherine Blodgett, working on a project originally instituted by Dr. Irving Langmuir, employed films of barium stearate and other fatty acids to form a thin molecular surface on glass. The glass was dipped into a tank of liquid on the surface of which an insoluble soap one molecule thick was placed. As the glass was dipped down one layer of film was attached, and on withdrawal another layer was applied, each full immersion adding two layers, each one molecule thick. It took 44 successive layers to build up a film to a thickness of a quarter wave-length of light. Dr. Blodgett came to the conclusion that except for the loss of light by absorption in the glass itself, film-treated lenses could be made to transmit 100% of the incident light!

The metallic fluorides, however, are much tougher films than the fatty acid types. In the long series of investigations conducted by Dr. W. B. Rayton in the B. & L. laboratories during this period, it was evident that a combina-

tion of two processes could be used to greatest advantage. On lenses having an exposed outer surface a corrosive chemical process is used in which oxides of high refractive index are removed from the surface leaving an invisible structure of silica; while the inner glass-air surfaces are coated by the deposition of a metallic fluoride in a high vacuum.

● Reflection Neutralized

In both processes the coating is held to a thickness of a quarter wave-length of light, or about four-millionths of an inch. The film must be intermediate in refractive index between air and glass. Since both the film and the lens surface reflect light, it is necessary that the crests of the waves from one beam shall fall into the troughs of the other; thus being out of phase the waves neutralize each other and reflection is decreased or entirely eliminated. The missing radiation reappears in the transmitted beam which has been shown to contain as much as 99.6% of the original radiation.

From 4% to 6% of the incident light is lost at each glass-air surface of a lens, the precise amount depending upon the type of glass used and the color of the light. A crown glass-air surface reflects about 4% of the light, whereas flint reflects 6%. It will readily be seen that in a lens with a number of elements, or in optical instruments with complex systems of optical parts, light transmission can be increased tremendously. Equally important is the reduction of halo and the improvement in image contrast.

The new coating processes are at present being confined to a limited number of products, but the progress so far attained offers a wide field for experiment which may prove a great step forward in optics.

[NOTE: Indicative of the widespread interest in this improved process of lens coating is the paper relating thereto which will be presented by Dr. C. Hawley Cartwright, of the Mass. Institute of Technology, before the meeting of the Atlantic Coast Section of the S.M.P.E. on March 13th at the Hotel Pennsylvania, N. Y. City.

Further data concerning this process will be published in these columns as soon as it is available. Queries from the field are invited.—ED.]

ALLIED HEAD SLAMS UNION WAR ON NEELY BILL

A de luxe burn-up anent Labor opposition to the Neely Bill was exhibited by Abram Meyers, chairman of board of directors of Allied Theatre Owners of America, in his annual report to that body. Terming the Labor stand with the producers a "seeming unholy alliance," the Allied head said:

"Certain leaders have succeeded in propelling organized labor into industry politics on the side of the motion picture trust. How this came about can only be surmised . . . but I want to call your attention to the use being made of the unions—not only those connected with the motion picture business but all affiliated with A. F. of L.—in fighting the Neely Bill."

Meyers contended that this policy would not commend itself to the American public which, on the whole, is most sympathetic to organized labor.

[NOTE: There's nothing "unholy" or pernicious about I. P.'s advice to projection craft to sock the Neely Bill, and hard, by means of statements by themselves and everybody else they can produce addressed to their congressmen in Washington. I. P.'s opposition to this bill reflects its opinion that the Neely measure, if passed by the House (it has already passed the Senate), will place an impossible burden on the picture business (for reasons heretofore cited in these columns) and, not the least important, will put the government in the picture business and result in rigid censorship.—ED.]

NYSAP OPPOSES NEELY BILL

New York State Projectionists Assoc., at its recent convention in Syracuse, N. Y., unanimously adopted a resolution registering unwavering opposition to the Neely Bill, to any modification thereof, or to any substitute therefor.

ZANUCK TO HEAD RESEARCH COUNCIL OF ACADEMY

Darryl F. Zanuck, of 20th Century-Fox studios, will direct the cooperative technical program of the Academy of M. P. Arts and Sciences during 1940, as chairman of the Research Council. He will represent the producing companies in directing the Council's efforts to raise efficiency, lower costs and improve sound and picture quality, encompassing the fields of photography, processing, recording, optics and theatre projection.

CANCEL 10% PAY RISE, ASK STUDIOS AFTER AUDITS

Following completion of an audit of their books to determine the effect of the European wars on foreign revenue, major producers have decided to ask the I. A. to surrender the 10% wage increase granted studio crafts last November. Get-together is skedded for Feb. 15 in Hollywood, general opinion being that I. A. will not voluntarily let go on increase. This will automatically throw the matter into arbitration, as provided in agreement of last Fall.

Producers, backed by the audits, are confident that arbitration proceedings will cancel out pay tilt, thus leaving I. A. with no legitimate basis for squawk.

U. S. GAINS 1302 HOUSES DURING 1939; DATA

Theatres operating in the United States increased 1,302 during 1939, according to a survey completed recently by *The Film Daily*. As of Jan. 1, there were 17,003 houses open, compared with 15,701 a year ago.

Seating capacities increased, during the same period, by 429,978—or an average of about 400 seats for each of the theatres opened during the year, discounting any increases in established seating capacities. Total seats in lighted houses at the first of this year was 10,462,808, compared with 9,996,830 on Jan. 1, 1939.

Total of all theatres, both open and dark, is 19,032. A year ago the figure was 17,829. Closed houses figures are: 1940: 2,029; 1939: 2,128.

GOLDE PROJ. ROOM TABLE

The new GoldE steel projection room table is made in both 5- and 6-foot lengths. Top is of heavy gauge cold rolled steel, formed and reinforced at all corners. The 5-foot table has one drawer; the 6-foot model has two. It is of sturdy construction and welded throughout, no bolts or rivets being employed. All joints are solidly welded, legs of heavy angle iron welded to body and with cross braces, also a leveling device. A feature appreciated by projectionists is the lip at the back of the table to prevent tools, schedules, and other items from falling off the back end.

NEW COMERFORD-ALTEC PACT

Comerford Theatres and affiliated companies have renewed service contracts with Altec for their 80 theatres in Penna., and have enlarged their repair and replacement contracts to include complete projection room equipment, under the new Altec inclusive service contract.

Brenkert Ready Soon With Intermediate Suprex Lamp

BRENKERT Light Projection Co. announces that in the very near future it will market a new intermediate size projection lamp operating at 30 to 40 amperes. D.C. type, and producing white light on the screen, with a lumen output of from 1500 to 2200 lumens with the shutter running, and an operating cost of carbons and current from 11c. per hour to 15c. per hour. The varying costs of operation per hour is dependent upon the number of lumens desired on the screen within the aforementioned range.

This Brenkert lamp is entirely new and is said to operate at the lowest arc wattage of any arc lamp yet used in the motion picture theatre. Power sources will be on the market at the same time, and purchasers can choose whether they desire rectifiers or generator that will be offered with the lamp.

● Uniformity, Interchangeability

Brenkert states that all lamps shipped from the factory will be made over jigs and dies and special tools that render all parts uniform and interchangeable. Quantity production is now under way.

The new Brenkert lamp fills the large field of sale for theatres that do not require the screen intensity produced by the present Enarc lamp, but which desire more illumination than the low-intensity lamp can produce. High efficiency of the power source and the lamp and extremely accurate operation are promised outstanding features of this new product.

The Intermediate H.-I. Suprex Lamp: Design and Operating Data

By *HARRY STRONG*
STRONG ELECTRIC CORPORATION

Marked improvement in the negative Suprex carbon, effected by National Carbon Co., permitting the burning of this type carbon at the comparatively low current rating of 40 amperes at 27½ volts, has resulted in the introduction of the so-called Intermediate Suprex arc lamp. The resultant sharp cut in original and operating costs thus effected, combined with the maintenance of high quality screen light, has occasioned widespread interest among projectionists in medium- and small-size theatres.

These lamps are now available through two manufacturers: the Utility High from Strong Electric Corp., and the Simplex-Hi from International Projector Corp. (N.T.S.). The accompanying article by Harry Strong tells us all about this new job.

THE response to the announcement of the new intermediate high-intensity d.c. arc lamp which appeared in the last issue of I. P. is most gratifying and is a tribute to the alertness of those projectionists who have long been awaiting the arrival of such a light source adaptable to the small- and medium-sized theatres. Answers to many of the questions posed by projectionists are contained in this article.

It is generally recognized in projection circles that the low-intensity arc lamp falls far short of meeting the requirements of present projection standards, and particularly so with respect to color motion pictures. This two-fold deficiency relates to both quantity and quality of light, but more particularly the latter in view of the yellow, muddy-appearing light of the low-intensity arc by comparison with the light produced by the Suprex arc.

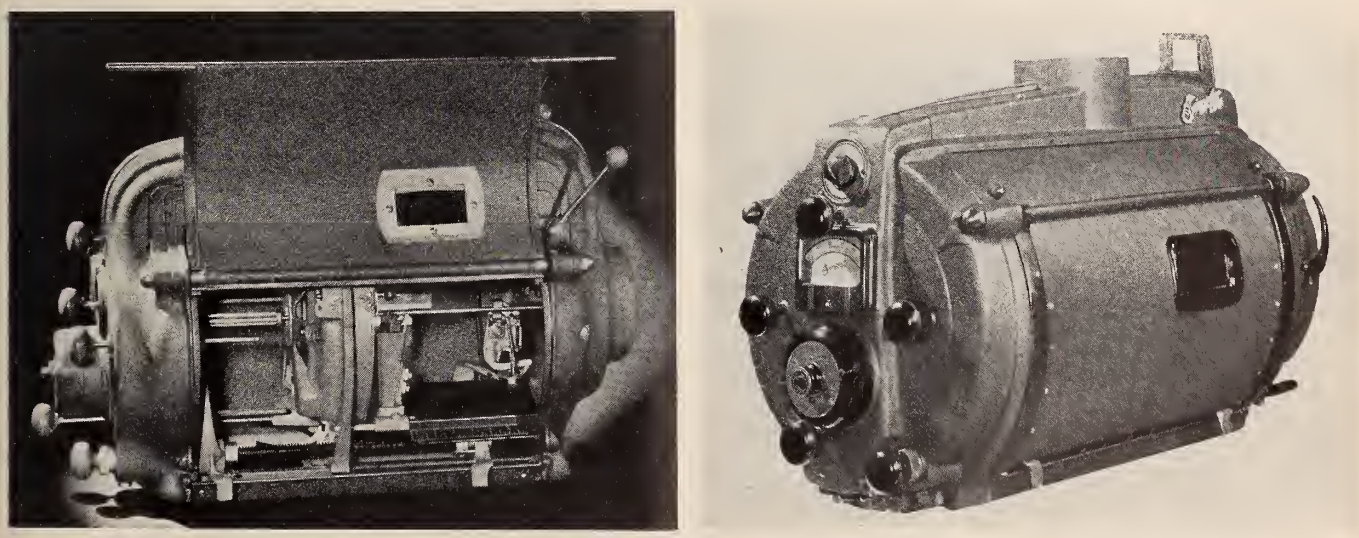
● Reduced Amperage Effect

The new intermediate high-intensity arc lamp is the logical result of experience gained through years of experimentation and research preceding the introduction in 1937 of the Strong Junior High, a high-intensity light source for 16 mm. projection. It was in this lamp that we encountered many of the fundamental problems the solution of which paved the way for this new arc, such as (1) instability of a high-intensity or gas arc when operating at low current; (2) suitable conversion equipment; (3) long-burning carbons required by the standard 16 mm. reel of 1600 feet which runs for nearly an hour; (4) low current consumption necessitated by portable equipment, and (5) a control system that would feed these carbons without manual adjustment for a period of an hour, particularly since the equipment would be used by a non-professional projectionist.

Many attempts have been made to adapt the conventional high-intensity reflector type lamp to the requirements of the smaller theatre by operating the arc at lower amperage. Any attempt to secure economical operation of the conventional high-intensity arc by burning a 5 mm. negative and 6 mm. positive trim of carbons at 35 amperes, instead of the 6 mm. and 7 mm. trim at 50 amperes, for which the lamp was designed, is defeated by the fact that the smaller carbons are consumed at the same rate as the larger sizes and the cost per inch of both size carbons is the same.

For years the general opinion among projectionists has been that if Suprex carbons could be burned at lower than recommended amperage, there would be not only a general overall lowering of screen brilliancy but also a corresponding reduction in operating costs. This would have been all very well, if it had been possible, but those who tried to burn high-intensity lamps at currents lower than those for which the lamps and carbons were designed soon learned that there were numerous difficulties which would have to be overcome before this change was practical.

First, the reduced arc amperage with resultant low arc voltage and necessary short arc gap length caused a



Two current models of intermediate h.-i. Suprex lamps. Left: the Strong Utility; right: the Simplex-Hi.

brown insulating bead, commonly referred to as a carbide tip, to form on the burning end of the negative carbon. This insulating tip prevented stable burning of the arc with cycles of color change on the screen.

As the arc current was reduced, the unexpected happened: instead of a general lowering of screen light intensity over the entire screen area, the center screen brilliancy remained fairly constant, all the reduction in light being at the corners; in other words, there was a hot spot in the center, with dark corners.

In spite of anything the projectionist could do, the carbons would occasionally and without warning run together, or the arc gap length would become so long that the light on the screen would wash out to a sickly blue.

● Improve Carbon, Feed

The correction of the carbide tip problem, which at one time seemed to be the most perplexing, was worked out by National Carbon Co., which produced the 5½ mm. anti-carbide tip negative for use in the 16 mm. arc and now the new 6 mm. Orotip (C) that has been adapted to the new intermediate high-intensity d.c. arc.

While the stability of the arc was materially improved by the development of this new carbon, there still was color change as a result of the reduced gas flow, caused by the lower amperage and slower carbon consumption. This necessitated the redesigning of the complete magnetic field surrounding the arc, and out of this development has come many patentable features, covering a d.c. high-intensity arc of such stability as to delight the experienced projectionist, and a steady white light with no color change as the natural consequence of holding the gas ball to a definite position and shape.

Projectionists who have been annoyed by the fluttering of the high-intensity arc with its associated unstable ammeter and continual need for manual adjustment, or the temperamental operating characteristics of the a.c. lamp, will welcome enthusiastically this new intermediate d.c. arc.

As previously mentioned, the reduction of amperage heretofore did not reduce brilliancy uniformly over the entire screen area but resulted in a "hot spot" at the center and a tremendous fall-off at the corners. This was because the reduction in amperage resulted in a smaller arc crater, the reflection of which was not large enough to cover the entire aperture. The change in light source has required an optical system having a higher magnification so as to enlarge the spot to fully cover the aperture.

The burning of Suprex carbons at low current densities has presented many problems relating to carbon feed, thus it might be well to review the characteristics of some earlier types of arc to the end that the control mechanism of this new arc be better understood.

The carbon feeding means used on the low-intensity lamp is based on the principle that the voltage across the arc changes directly with the arc gap length. When the carbons are separated the voltage across the arc naturally increases, and when the carbons are brought together this voltage decreases. The normal burning low-intensity arc with a 5/16-inch gap has a drop across the arc of 55 volts. If the carbons be separated by as little as 1/32 inch, this potential will be increased to 56 volts, or if the carbons are run together by an equal amount, the potential across the arc is accordingly dropped to 54 volts.

Advantage of this change in arc voltage is used to govern the speed of the carbon feeding motor to immediately correct the 1/32 inch error and return the carbons to their original arc gap length of 5/16 inch.

However, since the voltage across the gap of a Suprex arc is not necessarily dependent on the arc gap length alone, it follows that the accurate feeding of Suprex carbons must be based on some different phenonema, thus advantage has been taken of the fact that when the Suprex carbon is burned near its rated amperage, the burning rate of the positive varies greatly with a slight change in amperage.

Referring to Fig. 1 you will note that when the arc burns at 50 amperes an increase of only ½ ampere results in a corresponding increase in the carbon burning rate of from 9 inches per hour to 10 inches per hour. This 1-inch increase in burning rate amounts to a change of 10 per cent.

If for any reason the arc gap length is reduced by as little as 1/10 inch, there results an immediate increase in amperage enough to perceptibly increase the burning rate of the positive carbon. This increase in amperage in turn increases the burning rate of the carbons until they automatically burn back where the arc gap length increases to its predetermined 5/16 of an inch, thereby reestablishing the correct arc amperage.

However, if this same 7 mm. Suprex carbon is burned at only 40 amperes, reference to Fig. 1 shows that a slight change of about 1/10 inch in the arc gap length, with a comparative increase in current of 2 amperes, will result in a very small percentage of change in the carbon burning rate, thus the carbons continue to creep closer and closer together with no means for correcting this abnormal condition.

Accordingly, when Suprex carbons are burned at low amperage a special power supply that changes its amperage sharply with only a small change in arc gap length becomes necessary.

● Anent Power Supply

This special power supply, while maintaining 40 amperes at 27½ volts across the arc under normal operation, must have the additional properties of increasing and decreasing by several amperes for even minute voltage changes across the arc caused by variations in arc gap length of only a few thousandths of an inch. This is exactly the reverse of the condition which has hitherto been necessary in the power supply for burning either low-intensity or Suprex carbons, where for stability it is customary to have a rather high generator voltage with line ballast resistance so that the current

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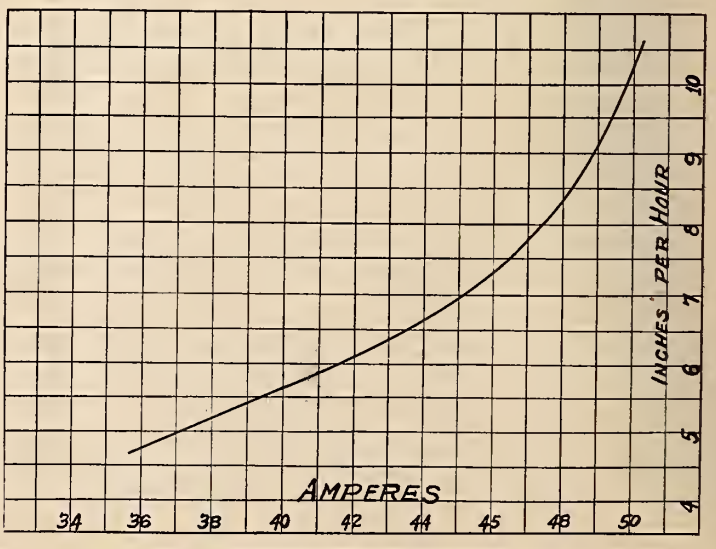


FIGURE 1

Increase in carbon consumption with increase in current

(Table courtesy of National Carbon Co.)

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

DO YOU know what to do when your motor-generator fails to build up after an overnight shutdown? Here's some of the things Altec service inspectors do to bring a generator "back to life":

1. Run the machine for from 15 to 20 minutes to heat the brushes by friction on the commutator. This will often lower the brush contact resistance.

2. Put a maximum electrical load on the generator. In many cases this will cause it to pick up to its normal voltage. Since a relative large proportion of the field excitation is usually furnished by a series field winding, if any residual magnitude remains to cause a small voltage to build up, the addition of maximum load will be effective in increasing excitation.

3. A more drastic application of the foregoing consists in placing a momentary short-circuit across the generator output, the short circuit prefer being effected by means of a ½-ohm resistance or a fuse of not more than 20-ampere capacity. Some electrical load should be on the generator to maintain the current if the momentary short-circuit is successful in building up the excitation.

4. Additional useful voltage to build up the field may be obtained by momentarily short-circuiting the active section of the field resistor; or

5. Shunt a 1.5-volt battery across the field resistance with the generator load on. The battery must be properly polarized relative to the generator voltage.

If the above excitation does not work, call your serviceman, since a serious defect may be present in the generator, or more complicated methods of re-excitation may be required.

• • •

R. H. Bisbee, RCA engineer in the New York area, uses an eye-dropper filled with carbon-tet to clean those hard-to-get-at places in a mechanism when time is limited. Oil may be applied with the same instrument.

• • •

A handy tool carried by many of the RCA engineers is the common nut-pick. The pick greatly aids in removing screws that have been broken off flush with a casting as the result of tightening the screw too tight. The pick being slender, pointed and curved at the end, lends itself readily to backing out broken screws where working space is limited.

• • •

All that frys is not ham. At 9:20 p.m. on November 11, 1939, Projectionist ——— of the Jamaica Theatre, Jamaica Plains, Mass., distinctly picked up the scent and sound of freshly frying meat. He glanced through the porthole to be sure that a kitchen scene was not being projected on the screen.

There wasn't; so he looked further and decided that the gastronomical stimulant was coming from the W.E. 43-A Amplifier. He turned off the amplifier so as to continue the show on the output of the preceding amplifier and called his service inspector.

When Altecman F. H. Jennings arrived he took one quick look into the back of the ailing amplifier, held his nose, slammed the door back shut and sat down to make this terse notation on his emergency call report: "Mouse cooked and shorting across plate taps to V-3 and V-4 sockets of the T-4 Transformer."

Beware of mice. Amplifiers normally operate warm and serve as ideal winter apartments.

• • •

December 20th was a busy day for RCA Engineer W. W. Gilreath of Alexandria, La. First a service call to the Grand Theatre, Natchez, Miss., and on to the Pringle Theatre, Glenmore, La. to make an installation survey. From there to Natchitoches, La., where he became involved with two cows, killing one of them and badly damaging his car. The same evening an installation was made in the Crystal Theatre, Center, Texas. The events of the day numbered four and took place in three different states.

• • •

It's a baby girl (Sally) to RCA Engineer L. P. Yoh and wife, of Cincinnati.

• • •

Altec inspectors agree that there is one type of common emergency call which is entirely within the control of the projectionist. The type of call they refer to is blown fuses, which Altec inspectors answer to the tune of about twenty every month. A blown fuse quickly brings a performance to a stand-still.

It seems that the most common reason that projectionists cannot clear their own fuse troubles and thus avoid dark screen time is due to the inability to locate the defective fuse. One Altec inspector offers the following suggestion:

Post conspicuously the location of each fuse, indicating its size and the equipment which would be rendered inoperative in case of fuse failure. Still better, make a block schematic wiring diagram showing all fuse locations and frame this diagram neatly as though it were a picture. This little scheme should prevent the majority of fuse troubles.

Fuses in the primary power circuits should be checked in particular, which means tracing the power wiring all the way to the point where it enters the building. Old theatres are the most difficult, since fuses may be located in all sorts of out of way places—under the stage, in the basement, dark stairways, attics, false ceilings, *etc.*,—which makes locating them almost impossible during the zero hour confusion of an emergency breakdown. This difficulty applies to service inspectors as well as projectionists.

Recently a fuse of indeterminate location burned out in a Chicago theatre, and in order to get the show back on the screen without undue loss of time, it was necessary for the Altec service inspector to run a temporary power line to the projection room equipment until the power company ferreted out the hidden fuse.

Other Altec inspectors chorus: (a) Always have a full stock of spare fuses of the *right size*; (b) don't make a practice

CORRECTION

RCA Serves Saenger Houses

In the article "Sound System Servicing" which appeared in I. P. for Nov., 1939, page 11, it was stated that the Saenger Circuit of theatres maintained its own sound system servicing organization. This statement is incorrect: RCA has been servicing all Saenger theatres for more than two years now, to the complete satisfaction of the latter.

I. P. gladly makes this correction.

of saving burned-out fuses—they are as useless as empty peanut shells, and (c) check all fuses periodically and see that they make tight, clean contact in their sockets or clips.

• • •

The hobby of B. A. Susan, RCA engineer of Tulsa, Okla. is building working models of railroad engines. His latest is a 400-pound working model of the N. Y. Central, Hudson-type steam engine. This engine is powerful enough to haul 25 people and is constructed to scale, even down to the water injector and whistle. The model measures 8½ feet in length, holds 4 gallons of oil and 11 gallons of water.

• • •

In case of intermittent noise or low volume it is a good idea to always go over all switches in the sound system, both power and speech. Wiggle them, snap them on and off.

Many times it will be found that sputtering noises and mysterious intermittent drops in volume are caused by switches which have developed poor contacts. Poor contact may have resulted either from misuse, because operating the switch automatically cleans the contacts, or it may be due to excessive use which has caused the contacts to arc and open.

If such a switch is found, strap out the offending member until time permits replacement, cleaning or adjustment.

FROM different sections of the country come reports from RCA field engineers that projectionists are using a set of inter-office communication systems to monitor the sound reproduction just as it is being received in the auditorium. One unit is used as a microphone in front of the stage speakers, and the other unit placed in the projection room. Such an arrangement provides a check on the entire sound system, including the stage speakers.

• • •

The use of peroxide to clean fire-damaged projector and soundhead mechanisms is an old standard trick dug out of the RCA files, but well worth repeating from time to time. Many projectionists use water to remove this resinous coating deposited on the mechanism, but hydrogen peroxide will do the job better and much faster. Every drug store has it.

• • •

During the showing of a shoot-em-up western picture in the State Theatre, Vivian, La., someone shot the villain with a bb gun. The shell punctured the screen and became lodged between the aluminum throat and the cone of the 1425 RCA speaker unit. After the shooting, all the actors had a rattle in their voices, according to RCA engineer R. H. Steimpert, who removed the pellet.

• • •

If you have an occasion to remove a projector head which is installed with sound reproducers requiring shims, such as the Western Electric 206, 208 or D-Spec Attachments, *be sure to replace the exact shims in the exact positions in which they were found.*

If the proper shims are not used when the head is replaced, drawing up tightly on the mounting bolts will cause the main frame of the projector to warp. The shafts, gears, rollers and sprockets will be thrown out of perfect alignment, causing excessive wear and possible film damage and binding.

The proper amount of shims has been installed in all cases by your service or installation inspector.

• • •

Do you know what the RCA Kinegraphone was? Do you remember the fine picture "Wings" of the silent era? Originally this picture was shown exclusively at selected theatres with a specially trained crew of men who operated elaborate sound-effects devices backstage to add to the feeling of realism. This trained crew and the large orchestra was too costly to take to the smaller towns, so RCA was called upon to record on film the accompanying musical score and sound effects and to furnish apparatus for reproducing such recordings in the theatres.

These equipments were known by the name RCA Kinegraphones. The sound track was on a separate film which was run off by a film Phonograph operated in synchronism with the picture projector. The complete systems were operated by crews that moved from theatre to theatre.

• • •

Fred L. Brown, RCA engineer headquartered in Indianapolis, was a few miles out of town the other day when he was stopped by a State highway patrol car and advised that a certain theatre in Indianapolis was having sound trouble. Evidently engineer Brown leaves his license plate number as well as his phone number at the theatres he services.

• • •

Several RCA engineers report that projectionists in many theatres are adding sound to their silent trailers by making a disc record on one of the portable instantaneous recorders now on the market, and playing their recorded message over the non-sync.

• • •

The bases of vacuum tubes often vary appreciably in diameter. See that all vacuum tubes installed in shell type sockets fit snugly. If a tube with a small base fits loosely, correct this by winding two or three layers of gummed paper around its base. This stunt was devised by an Altec service inspector.

Loose fitting tubes will fit cock-eyed in their sockets and the two prongs opposite the pin will often develop poor contact.

• • •

How do *you* know that your reflector and positive crater are aligned on the optical axis of your projection mechanism?

MARVIN, PROJECTOR PIONEER, DIES AT 77; NOTED INVENTOR

Harry N. Marvin of Rye, N. Y., retired inventor and an early figure in the motion picture industry, died recently at the age of 77. Marvin was formerly president of the Biograph Co. and was associated with Thomas Edison in some of the first motion picture inventions.

The Biograph and Edison interests were merged as the Motion Picture Patents Co., an organization which controlled the most important patents in the business. Marvin retired in 1912. With E. B. Coopman he perfected the meterscope and from that device evolved the Biograph, a cumbersome type of projector. Marvin invented the electrical rock drill, the forerunner of the modern pneumatic drill, and also perfected the automatic tuning arrangement on radio sets.

POUGHKEEPSIE, N. Y. ELECTION

Recently elected officers of Poughkeepsie, N. Y., Local 499, are: Frank Van Etten, pres.; Dorland Eighmie, vice-pres.; K. C. Browne, b. a.; Louis J. Ross, sec.; T. Ulrish and W. Decker, exec. board, and these latter two plus J. Albeck comprise the trustees.

THE NATURE OF SOUND

Sound is created by the vibration of a body. This sound consists of a fundamental frequency of greatest intensity and overtones of lesser intensity which are multiples of the fundamentals. It is the overtones which give distinguishing characteristic to the source of the sound. We all know that middle C (256 cycles per second) played on two instruments that are alike, a flute and an oboe, sound quite different. It is the different overtones which make them sound different.

RATING ENERGY CONSUMPTION

To speak of a train traveling 40 miles per hour gives no information as to the total distance covered, unless the time during which it travels at this speed is specified. Likewise, to speak of 50 watts does not state the amount of energy involved unless the time during which this 50 watts is delivered is given. The power necessary to operate a lamp is the rated wattage of the lamp. For instance, when a lamp is burned, the wattage of the lamp multiplied by the hours it is burned will give the watthours (work) of electrical energy used.

INTERMEDIATE H.-I. SUPREX LAMP: DESIGN AND OPERATION

(*Continued from page* 24)

will remain constant over wide variations in arc gap length.

Should an intermediate high-intensity arc be operated from a constant current source such as an 80-volt generator or from 110-volt d.c. service, the arc itself will burn entirely satisfactorily as long as the proper arc gap length is maintained. This might continue for days, but, as mentioned previously, without warning the carbons might run together or separate enough to occasion considerable annoyance to the projectionist.

The application and coordination of all these electrical and mechanical functions has resulted in an associated lamp and rectifier unit which produces excellent results and offers simplicity of operation entailing no more care

and attention than the low-intensity lamps now in use. This new arc lamp projects the characteristic snow-white light of the high-intensity in a volume about twice that of the low-intensity lamp and at a combined current-carbon cost of only 2c an hour more.

In the belief that free and full discussion never hurt any worthy enterprise, further inquiries anent this new arc lamp are solicited from the field.

MECHANICAL DEVICE RESTRICTION WINS N. Y. COURT O. K.

(*Continued from page* 20)

decision to Labor generally, no less than because of the contradictory character of the affirmative and dissenting opinions, excerpts therefrom are appended hereto.

The affirmative and decisive opinion:

"It seems undisputed that their (musicians-stagehands) actions have been guided by the primary matter of self-interest. It is clear that the defendants were not singling out plaintiff for attack, but attacking plaintiff along with all others who contributed to the unemployment of their members by the use of mechanical music.

"It would seem to us that such con-

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duct on the defendant's part is justified as a legitimate endeavor of labor, even though it results in some injury to the plaintiff. Unquestionably the plaintiff has the legal right if it so desires, to produce opera with mechanical music in preference to live musicians; but these defendant unions would seem to have an equal right to seek, by lawful and orderly means, to prevent plaintiff from using mechanical music, because the use thereof deprives their members of employment.

Unions' Economic Interests

"The defendant takes the position that the economic factors of cost of production is no more important to the plaintiff than is the economic factor of employment to the defendant. They contend that both have interests to protect, and that the courts should not interfere in behalf of either contestant. The stagehands have a direct interest in the subject. The economic welfare of both unions is closely related to the theatrical profession.

"We think that the law should not take sides one way or the other in such a conflict. We find that the defendants were engaged in a legitimate labor activity and that the injunction herein is unwarranted.

"In the present case we are passing solely on the rights of the defendants who have a direct interest in the subject, to stop work in protest against the use of mechanical music. We have no other question involved. Judgment reversed with costs. Complaint dismissed."

The dissenting opinion:

"No labor dispute concerning wages,

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hours, health, safety, conditions of employment or right of collective bargaining is involved in this action. By availing itself of the invention the plaintiff gave employment to 50 singers who otherwise would have been unemployed. Its productions require a stage crew of six, and 23 local assistants. Through this enterprise many parts of the country which could not afford it otherwise enjoyed grand opera at reasonable prices.

"If the contentions of the defendants be correct, all progress resulting from inventions must cease if it interferes with the employment of some individuals even though it may afford employment and pleasure to thousands of people.

Bar to Technological Progress

"If the contentions of the defendant are upheld, we might just as well scrap nearly all mechanical inventions. Not only could it apply to musical ventures, but to a great many phases of every day life.

"We know of no legal right which justifies the coercion of the plaintiff to bring about the reorganization of its business by the elimination of the mechanical device which makes that business possible so as to compel the employment of instrumentalists entirely unnecessary in the plaintiff's organization, and whose compulsory employment means the death of the plaintiff's endeavor."

LAYOUT AND MAINTENANCE

(*Continued from page* 18)

concerned with heating the theatre auditorium.

For individual units in the projection room, electric heating is the only alternative. Although the NFPA regulations prohibit the use of electric heaters, this regulation was written in 1931, at which time no satisfactory electric heaters were available. Under no circumstances does the Committe recognize as suitable for projection room use the old conventional type of electric heater, or any other kind of electric heater having exposed heating elements.

For any type of individual electric heater that may be used, the heating element should be completely enclosed and this entire heating assembly and any blower or fan should be enclosed within a protective housing. The temperature of the outside surfaces of this housing should never rise above 115°F. This may require, in the design of the unit, provision for automatically shutting down the unit in case of a rise of temperature above this value or failure of the blower.

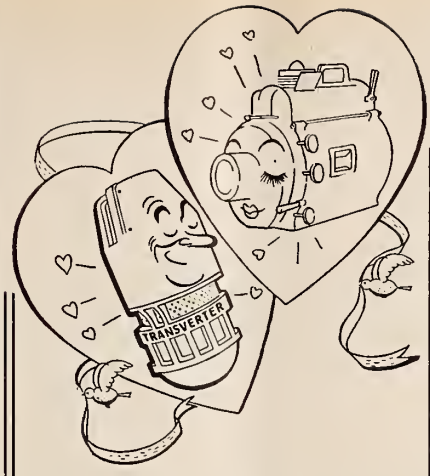
The protective housing shall be so constructed that no pieces of scrap film or the like may be able to enter through any openings or louvers provided to permit the exit of heated air or the entrance of cool air. The top of the casing should be made to slope or be rounded so that it can not be used as a shelf.

The heating unit (and blower) must conform in electrical design, wiring, installation, and circuit connections, to the requirements of the National Electrical Code.

The Sub-Committee on Fire Hazards has investigated the portable heating equipment available on the market and has found at least one portable electric heater designed and constructed in such fashion as to fulfill substantially all these requirements. The heater is available in several sizes, from 1 kw up, and has two degrees of heating —that is, provision is made for delivering heated air at a temperature of either 45° or 60°F above the ambient room temperature.

● Miscellaneous Activities

Other sub-committees of the Committee are engaged in projects not yet carried to the point where definite reports may be made. The Committee on Projector Output and Screen Illumination has done considerable work on methods and devices for measuring the light incident upon projection screens and reflected therefrom. The measurement of the incident light does



"Two hearts that beat as one"

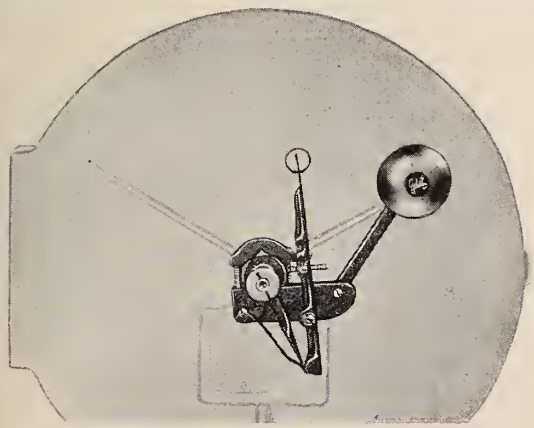
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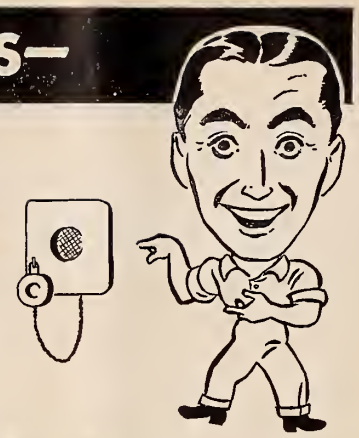
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not present any problem, in view of the fact that there is available on the market a simple, inexpensive light-meter with a built-in color-filter for simulating visual response to color.

The problem of measuring reflected light in a convenient, inexpensive, and simple way with equipment not requiring highly trained specialists, has not yet been solved. The Committee is investigating the problem further and hopes to be able to report more definitely at the next Convention.

The work of the Sub-Committee on Power Survey, described in the previous report of the Committee, is proceeding satisfactorily, and the Sub-Committee reports that approximately 600 of the questionnaires have been returned. The purpose of this study is to break down into its components the total electric power used in motion picture theatres, so as to determine the average or representative operating conditions in theatres of various seating capacities and equipped with various types of projection apparatus. The work has about reached the stage where anyalsis of the data may be undertaken and it is hoped that a comprehensive report may be available for the next Convention.

The Sub-Committee on Screen Border Illumination is investigating several methods of screen border lighting. some of which have received practical demonstrations in motion picture theatres, and one of which is in current use. Material on this subject is in the course of preparation.

DISCUSSION:

DR. GOLDSMITH: You will notice that the Projection Practice Committee has conducted extensive surveys to secure data of various sorts relative to theatres located throughout the United States, to assemble and correlate these data, and to study and analyze them in order that any exhibitor will be in a position to determine whether his theatre corresponds to average practice, better than average, or worse than average theatrical practice.

It is hoped that such information will be of help not only to the exhibitors in determining the technical or economic correctness of their present practice, but also to the architects of future theatres; and that it may in time serve as at least a partial guide in the design of theatres of more economic, practical, and attractive construction.

I may add that there have appeared before the Committee from time to time, and at its invitation, individuals who have presented on behalf of their companies or themselves pieces of equipment (such as heaters, measuring instruments, photometers, and the like), in order that the Committee might consider and study these. The Committee, of course, takes no part in any commercial issues but it does technically analyze devices and methods and consider their practicability.

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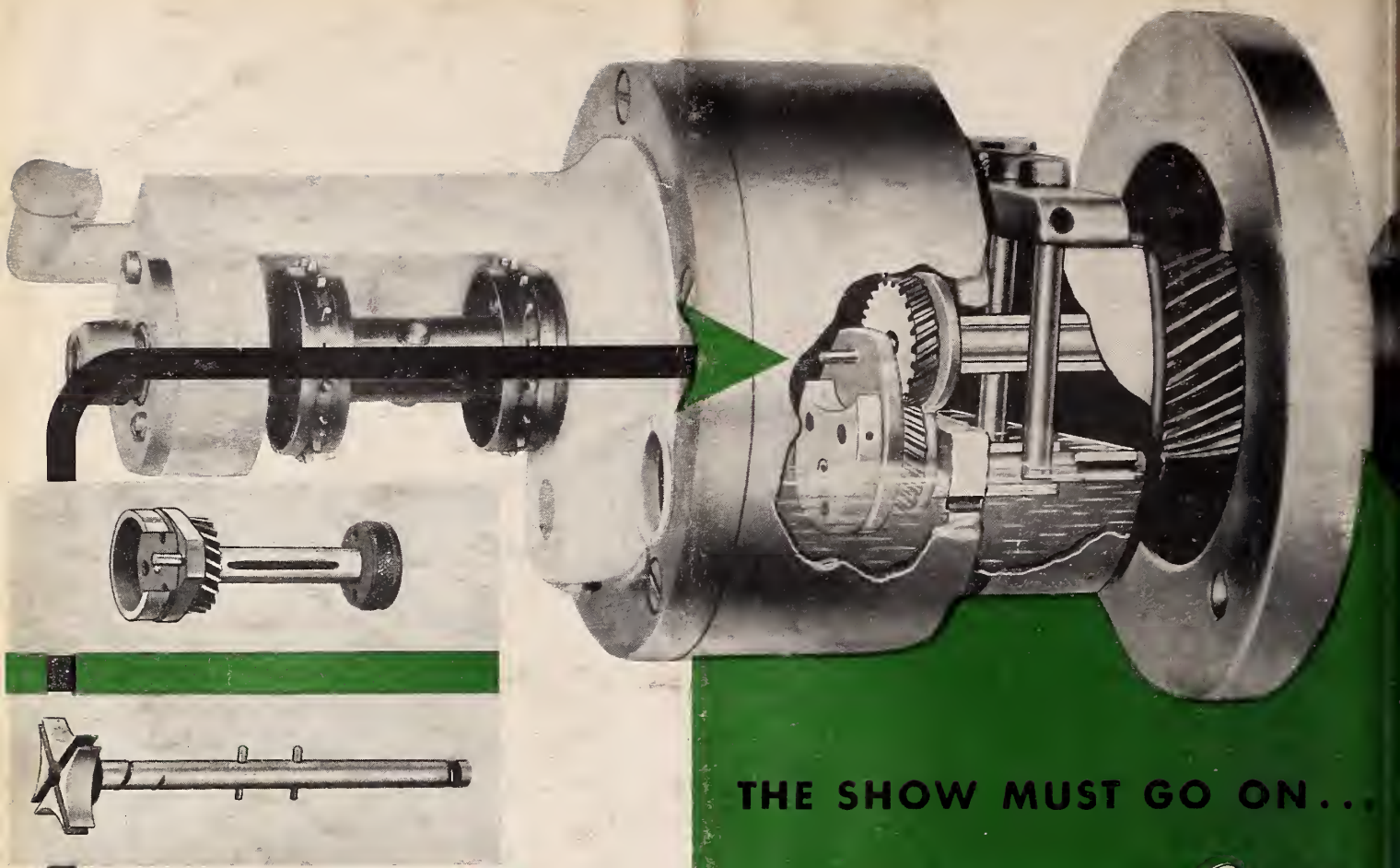
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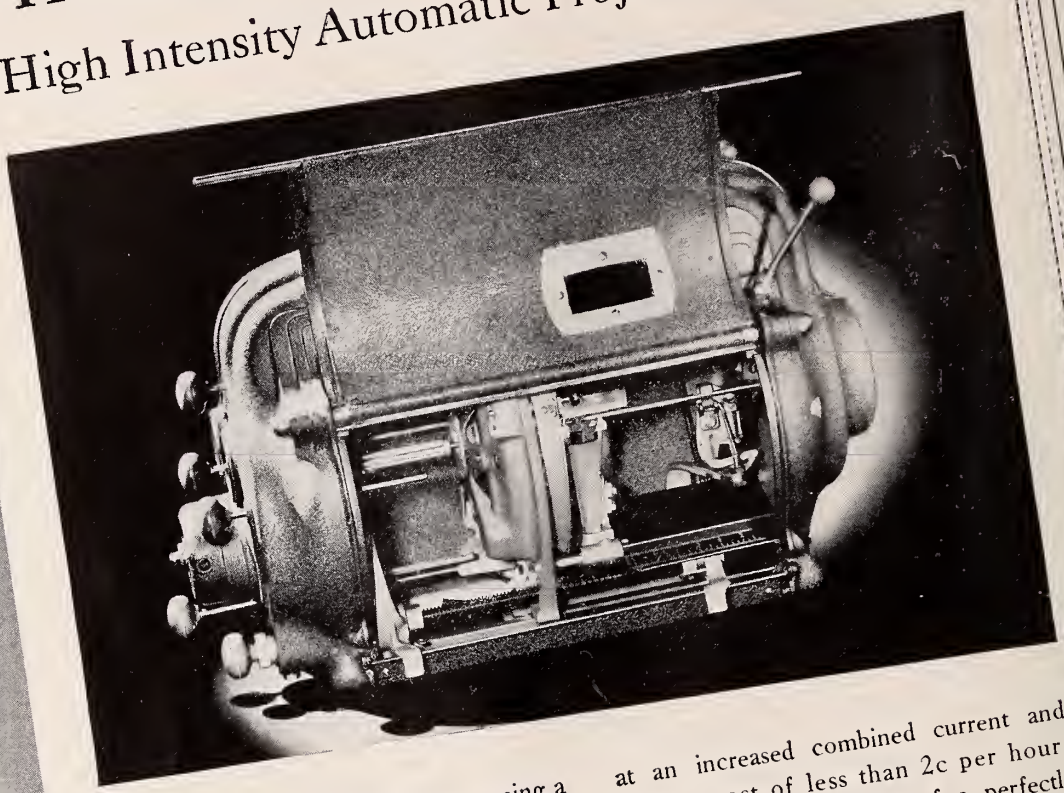
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The snow-white light secured by this new lamp makes the low intensity appear a muddy yellow by comparison.

An Independent Theatre Supply Dealer will arrange a demonstration in your theatre.

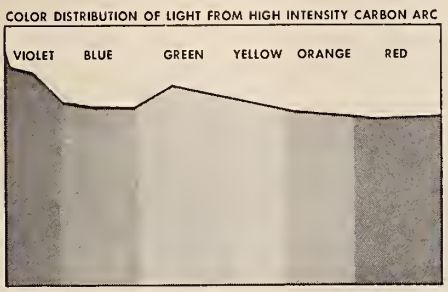
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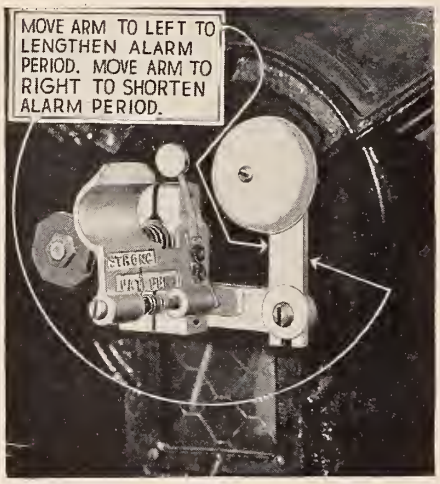
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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 15 FEBRUARY, 1940 *Number 2*

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Monthly Chat

I. P. IS being pressed by innumerable correspondents — including projectionists, manufacturers and supply dealers—for an expression of opinion on the new inclusive service contracts, covering the projection room complete and all equipment therein. We should like to oblige these many friends of I. P., but we find it difficult to view this matter as other than a strictly Labor proposition, to be decided by the I. A. itself.

Several correspondents point to the record of several years ago when, with a similar move underway, I. P. protested long and loudly and fought the plan to a standstill. Why, ask those who know press I. P. for an opinion, is the current situation any different from what it was in 1933 I. P.'s answer to this is that in 1933 the servicemen were not I. A. members; today all servicemen belong to the I. A.

The proposition, then, boils down to how the I. A. elects to divide the work among its members. Gratuitous advice from this corner might possibly be as unwelcome as it would be worthless. It can be said that the matter is even now being carefully considered by I. A. officials, who may be expected to announce their decision shortly. This is right and proper, because the manpower involved is 100% I. A. and there is no question involved as to "outsiders" moving in on the organized craft. Irrespective of what turn the matter takes, the work will continue to be done by I. A. men. This corner very properly should leave the decision to those whose business it is to decide such matters. Once a decision is forthcoming, I. P. can either actively support it or let it alone, as a matter of policy.

One correspondent states flatly that the establishment herein of the new department "At Your Service" was designed to disseminate "favorable propaganda" for the inclusive service plan. I. P.'s record to date on all matters affecting the welfare of the craft is such as to make ridiculous any such assertion. Moreover, the final outcome of this matter could not and will not be affected by any such subtle approach. When the decision is forthcoming it will be emphatic and conclusive.

• • •

Projectionists, no less than exhibitors, are deeply concerned over what turn the television art will take next. Its ultimate effect upon the means of their livelihoods is anybody's guess at this writing—although the broadcasters are insistently soothing in pooh-poohing suggestions that television will "murder" the movies. I. P., for its part, will continue its efforts to keep atop the latest developments in the television art, to the end that its readers may be well informed.



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INTERNATIONAL PROJECTIONIST

VOLUME XV FEBRUARY, 1940 NUMBER 2

Arcs—Their Operation and Light Output

By *W. E. FORSYTHE*

GENERAL ELECTRIC CO., NELA PARK, CLEVELAND, OHIO

THE two brightest sources of radiation that engineers know how to produce for continuous operation are both arcs—one operated practically in the open air, and the other very carefully made and enclosed in a small container. To convert electrical energy into radiation of a definite wavelength (not selected, however) an arc is generally used. About 130 years ago Sir Humphrey Davey had prepared for him a large high-voltage battery, and among the many things he experimented with was an arc. Of the materials he tried as electrodes, a well-charred piece of wood gave the most intense light.

Much work was done on arcs in the 70 years before Brush, in Cleveland, so improved the arc and the mechanism for operating it that it could be used as a source of light.

The statement is often made that Brush invented the carbon arc. He did not. He invented a carbon arc lamp and one type of mechanism for operating it. Another early pioneer of the electric field, Professor Elihu Thomson, a little later invented another mechanism for operating a carbon arc lamp, and an improved type of carbons.

● Some Characteristics

The early workers in this field described their "discharge" as "arcs," "sparks," and "glows," referring to the bowing of the sustained discharge, the scintillation of the momentary discharge and the diffuseness of the discharge in gas at reduced pressure.

At low gas pressure, the power density is too low to raise solids to incandescence or to change greatly the pressure. In the spark, the time is too short to transport much material from the electrodes to the center of gap, consequently the gas must furnish carriers. In a sustained arc, the material with the lowest ionizing potential, whether electrode or atmosphere, will control the passage of current, while the material with the lowest excitation potential will determine the character of the radiation.

Because of the low ionizing efficiency of positive ions, the cathode is usually the "neck of the bottle." Electrons from the cathode may be produced by the photoelectric effect, by field-emission, by thermionic emission due either to auxiliary heating or to positive ion bombardment, or, in some cases, to the "splash effect" by which positive ions, even at low velocities, liberate electrons.

In most parts of the discharge, positive and negative ions (including electrons) are present in nearly equivalent amounts ("plasma" of Langmuir), but near the electrodes there may be space charges giving cathode fall, and anode fall or rise, depending on the anode area. Due to the higher mobility of the electrons, the glass is negatively charged, and the same *may* happen to a large enough anode.

Arcs will not start with anything like the applied voltage with which they will operate, since they have negative characteristics; that is, with a sufficient applied voltage the current increases indefinitely unless there is something in the circuit to limit it.

● The Carbon Arc

Arcs may be further classified as open or enclosed. The carbon arc is probably the best example of an open arc; likewise a mercury arc is a good example of a completely enclosed arc. The electrodes may be heated independently to produce the necessary electrons to start the discharge and keep the arc operating.

When studying an arc, one may be interested in the hot cathode or anode, or one may be interested only in what takes place between the electrodes. Indeed, the electrodes may be made of some material whose only purpose is to produce electrons for starting and maintaining the arc, and then the interesting part is what takes place between the electrodes where the radiation is excited by the passage of the electric current.

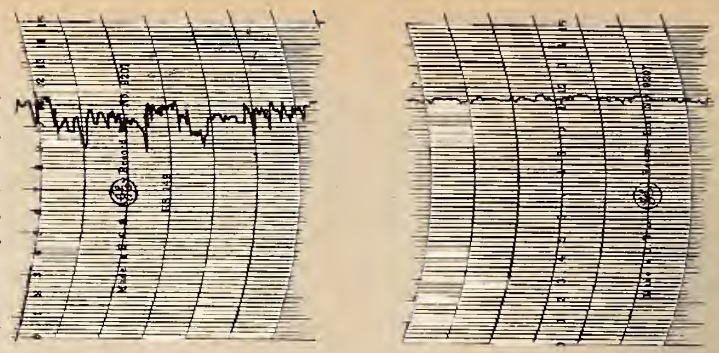
The carbon arc has many uses that are not connected with the production of light at all, but this discussion will be limited to arcs used to produce light or ultraviolet radiation.

The electrical input of carbon arcs used for projection and searchlights ranges from 20 amperes, 55 volts d.c. (1100 watts) for 10 mm. carbons, to about 200 amperes, 90 volts (18,000 watts) for 16 mm. carbons for high-intensity searchlight arcs. The first

has a total lumen output of about 16,500, and the latter about 555,000. Most of the light from this type of d.c. arc comes from the very hot positive crater. The electrons come from the cathodes which are kept hot by bombardment with the positive ions. The arc is carried from one carbon to the other by products vaporized from the carbon terminals.

To produce more light for the same wattage input, or to produce very special spectral distribution of radiation, either in the visible or ultraviolet part of the spectrum, the carbons are cored with selected materials. These salts or other compounds are heated to incandescence and assist in carrying the arc current and give the greater part of the light. Such carbon arcs may be operated on a.c. or d.c. The efficiency of light production runs from 45 to 65 lumens per watt. By selecting special materials for the cores, some arcs have been produced that give very satisfactory reproduction of radiation from the sun and others that give very intense radiation in the ultraviolet part of the spectrum.

Characteristics of some carbon arcs are shown in Table 1.



Comparative constancy of light output of an old and a new carbon arc as measured with a recording physical photometer. MR-40 Durac lamp, 40 amperes, 37 arc volts. Left: 8-mm. M.P. studio trim. Right: New 8-mm.—7-mm. trim

● Temperature Characteristics

For many years there have been controversies concerning the operating temperature of the positive electrodes of the carbon arc and whether the carbon was or was not melted in the arc. This argument started about 90 years ago when Despretz undertook to fuse all infusible substances. He claimed that he had fused carbon. About 44 years later Moissan built his electric furnace in which he was able to reach temperatures at which carbon volatilized freely, but he could find no trace of melting. In 1909 La-Rosa claimed to have found evidence of melting carbon filaments and rods heated electrically. He claimed that Moissan had not succeeded in reaching a high enough temperature to melt carbon.

In 1911 Mendenhall and Watts found no evidence of melting in any of their arcs and heated rods. They did find, however, that a graphite or carbon rod could be bent, and would take a permanent set, when heated to a very high temperature, without breaking. Their conclusion was that the carbon and graphite passed directly from a solid to a vapor, but became plastic at the high temperaure.

In 1914 Otto Lummer published his book on the "Melting of Carbon," describing many experiments to substantiate his ideas that the carbon was melted. He claimed that with the arc operated in a definite and prescribed manner one could see evidences of melting if the arc were properly observed.

During these same years there has been a controversy concerning the temperature reached by the carbon arc. Sometimes in the early eighties Violle observed that the graphite volatilized and estimated that the temperature was about 1880 K. Blondel made some experiments which led him to state that the temperature of the positive crater was variable and depended upon the kind of carbons used. However, he found a variation of only 10 per cent in brightness.

In 1904 Waidner and Burgess at the Bureau of Standards found that Atcheson graphite terminals ran about 40 degrees hotter than ordinary carbon, and that the temperature was increased by about 80 degrees by doubling the current through the arc. In 1906 M. Reich challenged the supposed idea of constancy of temperature, and claimed that the positive crater ran about 3140 K.

These questions were apparently dropped until 1930 or 1931 when Dr. Chaney and his co-workers at the National Carbon Co. laboratories were able to satisfactorily explain all of these discrepancies. By using a resistance-tube furnace they proved that they reach a temperature sufficiently high to vaporize the carbon. This happened at a brightness that corresponded to about 3750 K. No evidence was found of melting.

Chaney and his co-workers also showed how to operate a carbon arc that is so steady, so constant and so reproducible in its output that it can be used as a source of very high temperature for the calibration of optical pyrometers. These observers showed that the maximum constant brightness obtained depended not so much upon the nature of the carbons used as upon the size of the carbons and the method of operating the arc.

It was found much easier to produce this uniform steady brightness by the use of graphite electrodes than with ordinary carbons, but almost any type of carbon when run for a short time at this high temperature was so purified and so graphitized as to give this constant maximum brightness.

The chief advantage of the carbon arc is its high brightness and the fact that it can be operated at a very high efficiency in lumens per watt (40 to 65 lumens per watt). This enables one to get a very great amount of light in a very small space. The

TABLE 1.—CHARACTERISTICS OF SOME CARBON ARCS

Light Source	Current	Voltage	Color Temp.	C. P./mm² Brightness	Lumens Crater Light	Lumens Total
8-mm Nat. M.P. Studio Carbons*	40	37·5	4650	—	—	200,000*
12-mm Low Intensity Carbons	30	55	3550	180	25,900	25,900
6-mm Suprex Carbons†	40	32	5850	600	29,500	43,400
7-mm Suprex Carbons†	50	36	5950	625	41,200	60,500
8-mm Suprex Carbons†	65	38	6400	650	56,200	82,600
11-mm H. I. Carbons‡	90	57	6400	640	69,000	106,000
11-mm Super H. I. Carbons‡	135	75	—	1200	197,000	303,000
13.6-mm H. I. Carbons‡	125	65	5650	700	169,000	250,000
13.6-mm Super H. I. Carbons‡	180	75	5480	900	249,000	383,000
16-mm H. I. Carbons‡	150	70	6000	730	215,000	330,000

* Two arcs in series on 110–115 volt line and since it is a flame arc the intrinsic brilliancy of the light source (the arc stream between the electrodes) is low.

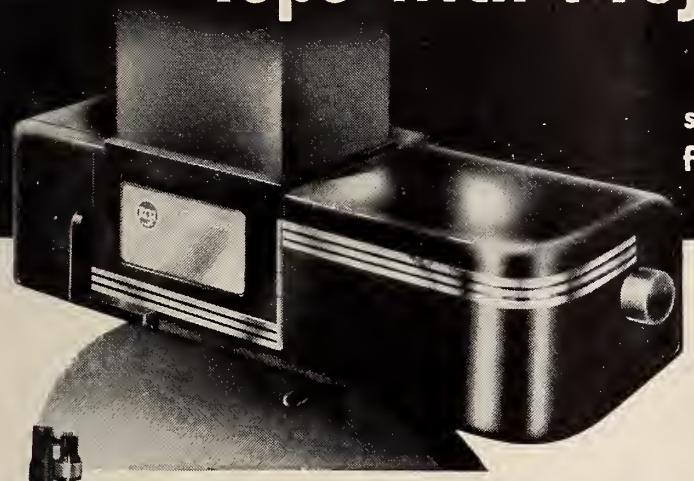
† Positive carbons stationary—do not rotate.

‡ Positive carbons rotate.

8 Outstanding Features

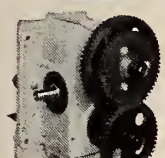
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Projectionists call this the No. 1 soundhead because its extra, exclusive features mean extra operating ease and efficiency!

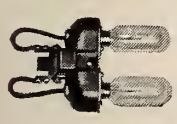




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3. TWIN SOCKET EXCITER LAMP HOLDER . . . This outstanding emergency feature permits you to speedily place spare lamp into service by simply reversing holder. Prefocused lamps eliminate all worry about lamp adjustment.

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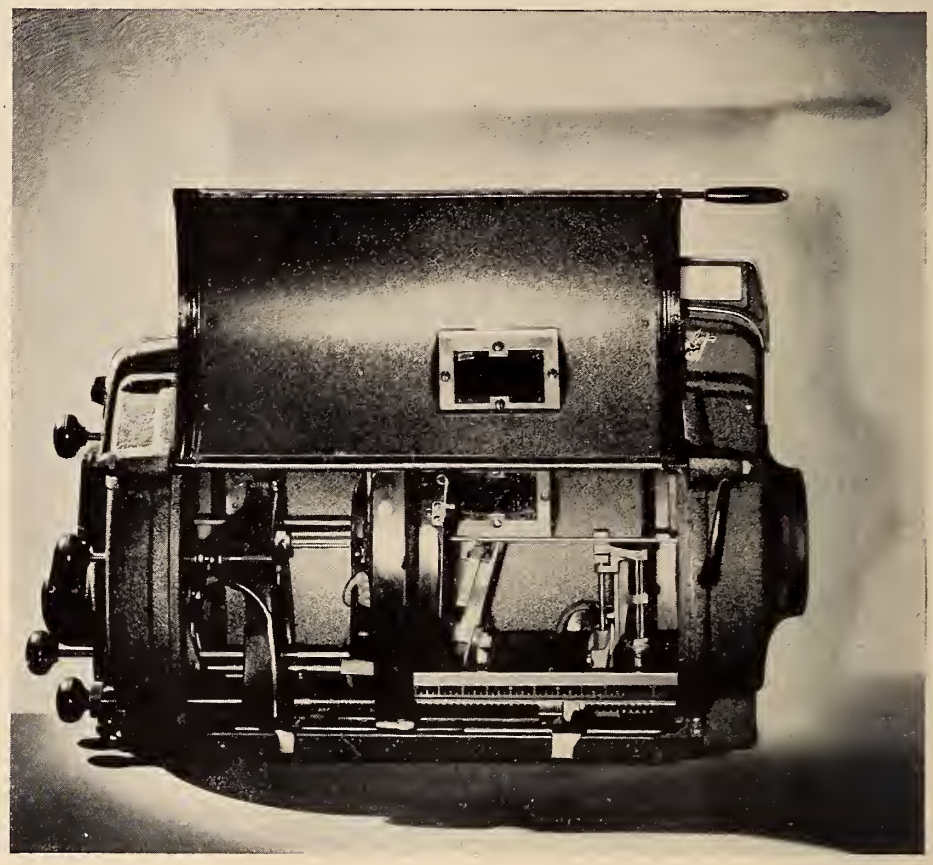
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brightness varies from about 160 candles per square mm. for the plain-carbon arc up to as high as 1200 candles per square mm. for a very special-cored 11 mm. carbon. This is very much higher than can be produced by any other source that we know how to operate continuously and for any practical length of life. The brightness of the sun as observed at the earth's surface is 1650 candles per square millimeter.

The fact that the carbon arc is so nearly a point source gives it great advantage for certain types of projection. Formerly two serious criticisms were made of the arc. One was that it was noisy, and the other that it was unsteady in its operation. Some recent work has very greatly overcome both of these shortcomings.

Many other materials have been used as arc terminals, and some such as tungsten are so easily oxidized that they must be enclosed in a vacuum-type container if they are to have any appreciable life. An enclosed tungsten arc sold under the name "Pointolite" has been in use for several years. This gives a more or less steady source with a brightness that varies from about 1000 to 4000 candles per square centimeter, depending upon its operating conditions.

Another tungsten arc that finds some use, particularly in microphotography. is an adaptation of the S-1 lamp—a tungsten mercury arc. This lamp has a solid ball of tungsten about 3 mm. in diameter as the cathode, and a ring electrode as the anode. The hot cathode is observed through the ring and gives a source of small size and uniform brightness that varies from about 3000 to 4000 candles per square centimeter. This arc current also is carried by ionizing mercury vapor.

One direct outcome of the work on the tungsten arc at Nela Park was the S-1 lamp—a tungsten-mercury arc. This is a mercury arc between hot tungsten electrodes and thus it gives off the mercury radiation, which, in this case, is very intense in the neighborhood of 2960A.

The sodium arc has been widely used as a source of light. The commercial sodium lamp is an arc between special electrodes with the arc stream carried by the sodium vapor. Due to its color and low brightness and the fact that the efficiency at which light can be produced is very high, this lamp is used in street lighting.

● The Mercury Arc

This brings us to the most interesting of all arcs, at least to those of us who have been studying it for the past several years—the mercury arc. The first commercial arc of this type was brought out some thirty years ago by Peter Cooper-Hewitt who invented this type of lamp, and established the Cooper-Hewitt Lamp Co. to manufacture it.

The first C-H commercial lamp was in the form of a tube, and, as genrally used, about 1 inch in diameter and 50 inches long, consumed about 250 watts and gave light at about 18 lumens per watt, later pushed up to about 24 lumens per watt. This is a low-pressure mercury arc, the pressure being only a fraction of a mm. The lamp was started by tilting the tube, which actually made and broke the circuit.

Work was started in Europe some eight years ago on a high-pressure mercury arc, and an a.c. mercury arc was developed which has a special oxide-coated electrode at each end. A small amount of neon was put inside of the bulb to aid in the starting, which was accomplished by using a special transformer with the proper characteristics. After the arc was started, the mercury was heated and the mercury vapor carried the discharge.

In order to keep the mercury vapor at the temperature desired, a double-walled bulb was used. Just enough mercury was put into the bulb so that it all was vaporized at the operating temperature of the lamp. This resulted in a lamp that was much less affected by the ambient temperature than the ordinary mercury arcs. Two lamps of this type are now being made: the H-1 which is a 400-watt lamp, and the H-2 which is a 250-watt lamp. These operate at an efficiency of 30 to 40 lumens per watt for about 2000 hours' life and give light of about the characteristic color of the older Hg arcs, having, however, some continuous radiation in the visible spectrum.

Professor Bol, who at the time was working at the Philips Lamp Co. in Eindhoven, Holland, brought out a real high-pressure mercury arc. He used a small quartz capillary tube about 2.5 cms long and 6 mm. external diameter with a bore about 2 mm. in diameter, and with electrodes at each end. The tube had a definite amount of mercury put into it which the current through the arc heated to such a temperature that a pressure of from 8 to 30 atmospheres was developed inside of the tube depending upon the lamp wattage. The higher pressure was about all even a quartz tube this size could stand with air cooling. Later water cooling was introduced.

Professor Bol later moved to California and continued his work on the high-pressure arcs at Stanford University. He made and operated a very high-pressure mercury arc—at least one having a very high voltage gradient. The lamp was in a small quartz tube having an arc length of 10 mm. and 1 mm. bore. This quartz tube was mounted in a steel container with water circulating between the steel and the quartz tube at a pressure of about 10,000 lbs. per square inch. The steel tube had a specially constructed quartz window for observation.

Characteristics of a number of mercury arcs are shown in Table 2.

These high-pressure mercury arcs are finding use in certain lighting fields and for the production of ultraviolet in the so-called therapeutic region. The air-cooled high-pressure mercury arcs are being used in sound recording and in the printing of pictures, and to some extent in the lighting of television studios. The water-cooled arc is being used in photo-engraving. Another very interesting arc is the low-pressure mercury arc, used as a source of primary radiation in many of the new fluorescent lamps.

Acknowledgement is made for help received from A. C. Downes of the National Carbon Co. in the preparation of that part of the paper pertaining to carbon arcs, and from E. B. Noel and B. T. Barnes of the G.E. laboratory for the data on the mercury arcs.

TABLE 2. ***Characteristics of some mercury arc lamps***

Lamp	Arc Volts	Arc Watts	Lumens	Arc L/W	Operating pressure (atmospheres)	Brightness Candles/mm²
Cooper-Hewitt	71	266	6500	24	.0003	.031
B H-1	150	400	16000	40	1.4	1.4
A H-2	68	250	7000	28	.4	1.0
A H-3	250	86	3400	40	28.5	18.0
A H-4	130	100	3300	33	8.	9.0
A H-5	140	240	10500	43	4.	4.0
A H-6	840	1000	65000	65	75.	300.0

Instrument for the Reduction of Flutter

By *R. J. Kowalski*
PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

ONE of the biggest problems encountered in the reproduction of recorded sound, is that of maintaining constant speed of the record as it passes the pickup point. Any irregularities in the motion of the record produce the "wows" and "flutter" so familiar to projectionists whose experience dates back to the early days of sound. While constant research and improved design and manufacturing methods have reduced the flutter content of the modern soundhead to the point where it cannot be detected by the ear, improper components or maladjustments still can introduce serious flutter in the best soundheads made today.

The term "wow" has generally been associated with any slow variations in the speed of the film at the scanning beam, such as those caused by a slipping drive belt or eccentric sprocket. The term "flutter," on the other hand, generally referred to speed variations of a higher frequency, such as the familiar "gate rasp" caused by improper adjustment of pressure type sound gates, or "sprocket-tooth ripple" caused by hooked or undercut sound sprockets.

Now, however, sound engineers choose to refer to all speed variations as flutter, since the only fundamental difference between "wow" and "flutter," as the term was originally used, is the frequency at which the variations occur. "Wows" are now technically known as low-frequency flutter; and disturbances in the nature of "sprocket-tooth ripple" are known as high-frequency flutter.

Since flutter is the result of variations in the linear speed of the film, it is apparent in the form of changes in the frequency of a recorded note. For example, if a film with a constant 3000-cycle note recorded on the sound track was reproduced by a soundhead which contains flutter, the output frequency of a soundhead would vary continuously between two limits, let us say between 2970 cycles and 3030 cycles.

If the variations occur at the rate of a few times a second, as is characteristic of low-frequency flutter, the changes in pitch are easily detected by the ear. "Sprocket-tooth ripple" produces a high-frequency flutter in which the variations occur at the rate of 96 times a second. These rapid changes in pitch are too fast for the ear to follow but result in very rasp, rough reproduction of high-frequency notes.

While it is easy to detect the effects of flutter with the ear, it is almost impossible to detect slight changes in flutter content, and hence unless some accurate measuring device is available as a guide it is very difficult to make the necessary adjustments to reduce flutter to a minimum.

TABLE A

$$\% \text{ Flutter} = \frac{(\textit{Maximum frequency} - \textit{minimum frequency})}{\text{Mean frequency}} \times 100$$

$$= \frac{(3030-2970)}{3000} \times 100 = \frac{60}{3000} \times 100 = 2\%$$

● Flutter Content Formula

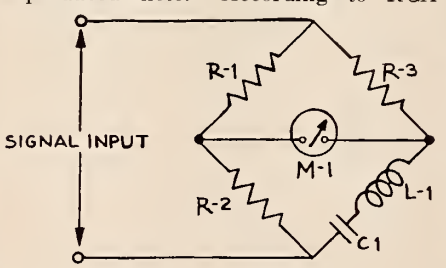
Measuring devices are generally calibrated to read per cent flutter, which is defined as the percentage change in linear speed of the film, or the percentage change in the frequency of a reproduced note. According to RCA standards, the variation in frequency cited in the foregoing example would represent a flutter content of 2%. This is calculated by the formula given in Table A.

Flutter measuring devices have been considered standard equipment in recording studios almost since the advent of sound pictures; however, since these instruments were designed for laboratory use they were too elaborate and unweidly for field use.

To meet the demand for a portable field instrument, the RCA Photophone Service Division designed a small compact unit which is completely self-contained and requires no external power supply. Tests have shown that results obtained with the RCA Flutter Indicator are comparable to measurements made on large laboratory instruments.

This instrument employs the simple Wheatstone Bridge principle with a sharply tuned circuit in one leg as shown in Fig. 1. Reactor L-1 and capacitor C-1 are tuned to resonance at 3000 cycles. The meter, M-1, placed across the bridge, responds to changes in frequency fed to the bridge in accordance with the graph shown in Fig. 1.

If the input frequency is exactly 3000 cycles, the meter will read zero; but if the input frequency varies above or below 3000 cycles, the meter will



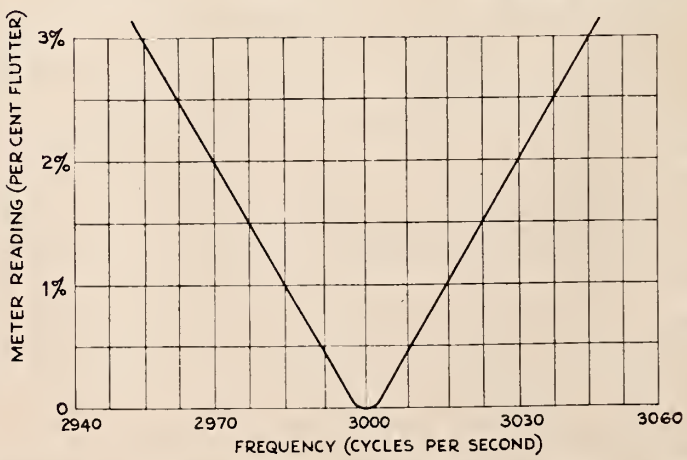


FIGURE 1

WORLD-WIDE SUPREMACY

NINE out of the Ten Best Pictures chosen in the *Film Daily's* 1939 critics' poll were made on Eastman Negative Films. Two of the Ten Best Pictures were made in England, and both were on Eastman—striking evidence of the world-wide recognition of this film's excellence. Eastman Kodak Company, Rochester, N. Y. (J. E. Brulatour, Inc., Distributors, Fort Lee, Chicago, Hollywood.)

NINE OF THE "TEN BEST" ON EASTMAN NEGATIVE

THE "FORUM" USES G-E COPPER OXIDE RECTIFIERS





Pictures by Earl Heister

Mr. Irl Gordon, owner of the Forum Theatre in Akron, Ohio, likes his G-E Copper Oxide Rectifiers. There are many other theatre owners, managers, and projectionists who feel the same way about General Electric Copper Oxide Rectifiers.

G-E Rectifiers provide projection lamps with that smooth, steady, reliable supply of current which makes excellent projection a reality. They do this cheaply because they consume little current themselves.

Here are some other reasons for the popularity enjoyed by G-E Copper Oxides in the motion picture industry:

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2. One control with power available instantly
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GENERAL ELECTRIC

show a deflection which is proportional to the amount of variation from 3000 cycles.

In using the flutter indicator, the instrument is connected directly to the output of the system amplifier and a specially recorded 3000-cycle test film is run through the soundhead under test. If the soundhead is free of flutter, the output frequency will remain steady, the bridge circuit will be balanced, and hence the meter will read zero. However, if the frequency varies due to irregularities in the motion of the film, these variations will unbalance the bridge circuit and give an indication on the meter.

● Flutter Unit Components

A complete schematic diagram of this flutter indicator is given in Fig. 2. An input transformer with several taps is provided so the instrument can properly terminate the system amplifier used for the tests without the use of additional loading resistors.

While the level of the signal fed into the bridge circuit is controlled primarily by the main system gain control, a vernier control, R-1, is incorporated in the instrument to facilitate adjustment. The signal then goes through a two-stage 300 cycle, band-pass filter (Capacitors C-1, C-2, C-3, C-4, C-5, C-6, and C-7 and Reactors L-1 and L-2) before being applied to the bridge network. This filter takes out any hum or harmonics which may originate in the amplifier system.

An attenuator pad (Resistors R-2, R-3, and R-4) may be cut in or out of the signal path by means of the "Range-Selector" switch. In this way two ranges of sensitivity are provided, either 0-0.5% or 0-2.0%. The double-pole, double-throw, "Read-Calibrate" switch connects meter, M-1, either to the input of the bridge or across the bridge so that the same meter may be used for calibration and for flutter readings. The meter is a standard Rectox type volume indicator with the dial hand-calibrated directly in the per cent flutter.

A variable capacitor, C-10, is provided in the tuned leg of the bridge circuit to shift slightly the frequency at which balance occurs to allow for small variations in the speed of different soundheads. A variable resistor, R-8, can be adjusted to compensate for slight changes in the effective D.C. resistance of the tuned leg.

Figure 3, which is a photograph of the completed instrument, illustrates the compactness and portability of this new service tool.

● Needle Action Import

Careful analysis of the action of the meter needle during tests will reveal many facts which may be useful in locating the source of flutter in a soundhead. Low-frequency flutter will show up as a slow variation in meter deflection. The frequency of the variation can generally be associated with the rotation of some moving part, which makes it relatively easy to locate the source of the flutter.

The amplitude of the deflection is an indication of the extent of the flutter. Since the meter needle cannot follow the rapid variations which are associated with high-frequency flutter, it will give a steady reading just as it would with a constant alternating current signal. The deflection of the meter indicates the magnitude of the flutter.

In making flutter measurements it is generally found that the meter needle moves slowly between two scale readings. The minimum reading can be interpreted as the per cent high frequency in the soundhead; and the difference between the maximum and minimum readings represents the low frequency flutter content. The maximum reading to which the meter swings after the instrument is properly balanced then represents the total flutter in the soundhead.

FIGURE 2

Schematic diagram of flutter indicator

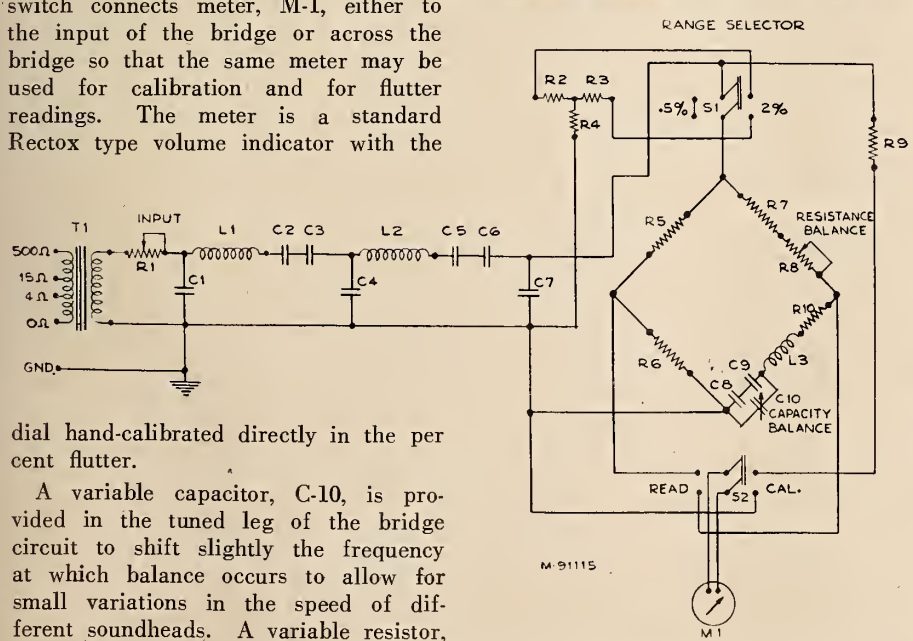




FIGURE 3

The flutter indicator may be used in making adjustments while the soundhead is in motion and hence provides a rapid, accurate method of obtaining optimum performance from any soundhead.

Barrows' Savvy Helped Found Film Delivery System

[NOTE: *Ten minutes of Thad Barrows' time to jot down the essential facts would have made an original yarn out of the appended story. However, the fact that it comes from another good publication in no wise detracts from its interest.*—ED.]

New England's film delivery system, proved during the recent storms which snow-bound many parts of this territory, was not always the smoothly working set-up it now is. The recent death of Harry Decker, late owner of the Film Exchange Transfer Co., brought to many minds these past few days the genesis of it all.

Thad Barrows, perpetual president of Local 182, I.A.T.S.E., came close to starting it all when he rebelled against the former custom of projectionists delivering reels to and from local exchanges.

Mailed In Checkroom Tabs

When the General Film Co. moved to the dark recess of Commercial Street and Atlantic Avenue by the Boston waterfront, Barrows adopted the practice of leaving his film cases at the South Station, local railroad terminal. He mailed the checking room tabs to the exchange office. Barrows' move gained momentum.

Ed Farrell, then manager of the General Film, contracted with the Fitzgerald Trucking Co. to handle local film transportation matters. As exhibitors and projectionists followed Barrows' example, other exchanges posted Decker nightly at the corner of Hayward Place and Washington St. to collect films from the boys.

Events progressed. More and more projectionists declined to be errand boys. A fire resulting in a local subway, perhaps because someone carried the celluloid in a paper bag and put the bundle too near a heater, precipitated the enactment of protective measures. Decker swapped a horse and wagon for a Ford truck. A new branch of the motion picture industry came into being.—*Box Office.*

SCHINE RENEWS ALTEC PACT

The Schine Circuit has renewed service contracts with Altec for 110 theatres in New York State, Ohio, Maryland, and Kentucky. Bert Sanford negotiated for Altec.

The Orthicon, A Television Pick-Up Tube

By *ALBERT ROSE* and *HARLEY IAMS*

RESEARCH AND ENGINEERING DEPARTMENT, RCA MANUFACTURING COMPANY, INC.

The electron gun type of pick-up tube, which has been called an Orthicon, has a maximum signal current output over 300 times the noise in a typical amplifier. The signal is proportional to light intensity. The resolution is sufficient for the transmission of a 441-line picture. Spurious signals are negligible. Within the accuracy of measurement, all the photoemission is converted into video signals.

THIS article will discuss an improved form of television pick-up tube. At the present time, the RCA television system uses Iconoscopes to convert the optical image into a sequence of video signals for transmission to the receiver.

Extensive tests have shown that the Iconoscope is capable of transmitting clear, sharp television images, even under conditions of unfavorable illumination. The spectral response is sufficiently like that of the human eye to give a natural appearance to the viewed scene. In the circuits associted with the tube, provision is made to "keystone" the deflection (so as to make the scanning beam move over the mosaic in a rectangular pattern), and to introduce shading signals into the amplifier (to compensate for the "dark spot" signal).

In the course of these tests, several significant discoveries were made. One of these was that the good operating sensitivity of the tube is obtained in spite of an operating efficiency only 5 or 10 per cent of that which is theoretically attainable. In other words, during typical operation only about one-third of the photoelectrons which the mosaic emits are drawn away, and only about one-quarter of the stored charge is effective in producing the video signal. This lowered efficiency is connected with the release of secondary electrons from the mosaic by the scanning beam.

Figure 1 shows the essential parts of an Iconoscope. Light in the optical image focused on the mosaic causes the emission of photoelectrons, leaving a pattern of charges corresponding in intensity to the light and shade of the scene to be transmitted. This pattern of charges is scanned by a beam of electrons, which strike the mosaic at high velocity.

On the average, each beam electron releases several secondary electrons. Since the mosaic is an insulated surface, the electron current leaving it must, on the average, be equal to the electron current arriving. Thus, when the tube is in darkness, only as many secondary electrons can escape from the mosaic as there are beam electrons which arrive. The rest of the secondary electrons fall back on the surface near or far from the point of emission. Nonuniformities in the escape and rain of secondary electrons cause the "dark spot" signal.

Many of the numerous secondary electrons are emitted with appreciable velocity, so that the condition of one secondary electron leaving for each beam electron arriving means that the electric field near the mosaic is such as to hinder the escape of secondary electrons. This field also reduces the escape of the photoelectrons, which have lower average emission velocity.

When the mosaic is lighted, those photoelectrons which escape contribute a positive charge to the lighted parts of the surface. These charges are partly dissipated by the rain of secondary electrons, but sufficient charge is stored during a frame period to produce a strong signal in an amplifier connected to the signal plate when the beam releases the stored charge.

● L-V Beam Scanning

If one could ignore the immediate practical problems and choose an ideal mode of operation for a television pick-up tube, he might want to provide a field strong enough to draw away all of the photoelectrons which are emitted, and he might prefer to do the scanning without involving secondary emission in the process. These conditions can be met by operating the mosaic, in known fashion, at the potential of the cathode in the electron gun.

Cathode-voltage operation is possible, for the potential of an insulated surface exposed to an electron beam is stable at this voltage. High-vacuum cathode-ray tubes are usually operated so that the beam electrons strike the screen with high velocity, and liberate many secondary electrons. The screen poten-

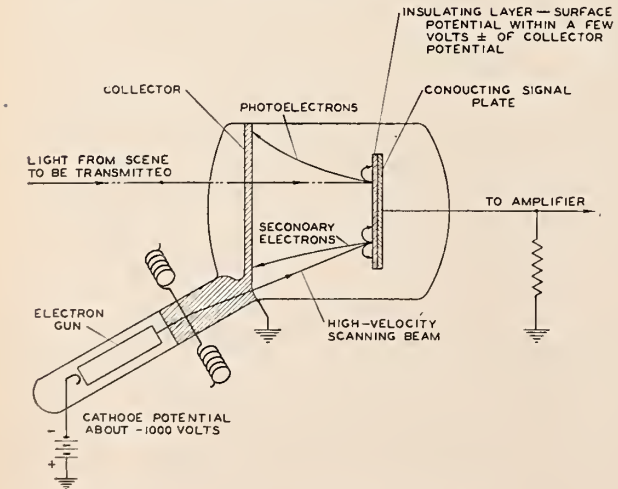


FIGURE 1
Schematic diagram of an Iconoscope

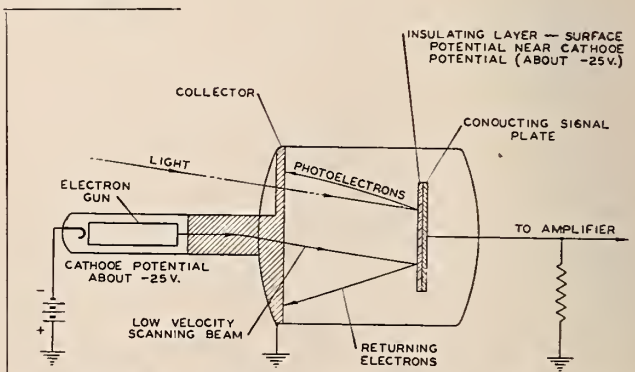


FIGURE 2. *Pick-up tube with cathode potential target*

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Exchange work makes exacting demands upon a film binding agent. The splice must be made secure—and quickly. Now, in Warner exchanges splices are made the modern way—with FILM-WELD, the successor to film cement. Now, America's theatres receive Warner reels with thinner yet more rugged splices.

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And why not? Warner exchanges now need not empty their cement bottles twice daily, nor be careful not to expose too much cement at one time. Because FILM-WELD does not thicken, spoil or discolor—even when exposed to the air. It retains its full strength down to the last drop, requiring no thinning agent. It firmly binds all film—nitrate, acetate, black-and-white and color. It goes twice as far as ordinary film cement—naturally.

First proven best on the projection firing line in thousands of theatres, FILM-WELD now delivers perfect results in major exchanges. And Warner is but the first such group to adopt FILM-WELD—more are on the way. Get your FILM-WELD from any one of the 108 dealers throughout America who now stock this modern splicing agent.

Instructions for use

FILM-WELD should never be put into a container that has been used for film cement, or a brush used that has been used with film cement. Use FILM-WELD sparingly; just enough to moisten the film is sufficient, as any excess slows up the drying process.

On prints that have been treated with emulsion hardener, it is necessary not only to remove the emulsion, but the film itself must be scraped, so as to remove the hardener. The non-emulsion side should also be scraped.

Color film should be scraped on both sides.

FILM-WELD not being a cement but a bonding agent, it is absolutely necessary to remove any foreign matter so that the two films themselves are brought into contact.

If these directions are followed, a permanent bond will result.

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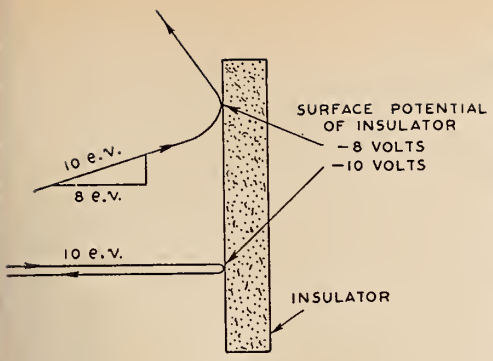


FIGURE 3

Electron paths near target

tial then adjusts itself (usually near anode voltage) so that the number of secondary electrons which escape is equal to the number of beam electrons which arrive. However, the other stable condition occurs when the surface is at cathode potential. The beam electrons then approach the target, but are repelled and retire without striking. If the target becomes slightly positive (by photoemission, for example), the beam electrons land without producing appreciable secondary emission and restore the original voltage.

Figure 2 illustrates the operation of a television pick-up tube with its photosensitive target at cathode potential. In the absence of light, the beam electrons approach the surface, are slowed to zero velocity, and then are drawn away. There is no signal in an amplifier connected to the signal plate. When light falls on the mosaic, all the photoelectrons are pulled away by the strong electrostatic field between the mosaic and the anode. The charges given the surface are not dissipated by a rain of electrons, but are stored until the scanning beam approaches.

When the beam comes near a lighted area, and finds it a few volts positive, electrons land until their negative charge brings the surface to cathode potential again. The velocity with which the beam electrons reach the surface is so low that secondary emission is not involved to any appreciable extent. The signal is simply due to the impulses given the signal plate by the beam electrons, as they arrive at the lighted parts of the target.

● Problems of Design

So far, much of the discussion has related to ideals. Some of the problems which must be solved before a pick-up tube can be made to operate in a satisfactory manner with its target at cathode potential are illustrated in Fig. 3. When the electron beam is deflected, in usual fashion, at an angle to the axis of the tube, the electrons do not approach the target perpendicularly. The negative voltage needed to keep an electron from landing on the mosaic is only as great as the component of velocity perpendicular to the mosaic, and the electric field is not able to stop motion parallel to the surface.

When conditions are as illustrated, the beam charges one part of the target to cathode potential, and other parts slightly more positively. Also, the point of contact of the beam may be elongated into a line. This situation may be expected to cause a loss of resolution at the edges of the picture, and unstable operation when the electrons move with considerable velocity tangent to the surface of the target. These considerations suggest that it would be preferable for the beam always to approach the mosaic nearly perpendicularly, or for the beam to be constrained.

Another important problem is that of providing sufficient beam current (about one microampere) in a beam which retains its small diameter when the electrons are slowed to almost zero velocity and are subject to strong local fields at the mosaic surface.

In the solution of these problems, a magnetic field perpendicular to the mosaic and extending to the source of the electron beam has been found useful. When the field is made sufficiently strong, the beam is focused and refocused many times between the cathode and the target. In a uniform magnetic field, the final size of the scanning spot is substantially the same as that of the source of the beam. The magnetic field can also be used to keep the beam electrons from proceeding very far across the surface of the mosaic at grazing incidence.

Electrons which tend to move in this fashion cut across the lines of flux, and move in circular paths. The diameter of these circles can be made as small as is desired by increasing the strength of the magnetic field.

Several types of pick-up tubes based upon these principles have been designed. In some, the scanning beam is developed at a photo-cathode illuminated by a moving spot of light; while in others the beam originates at a thermionic cathode. The name Orthiconoscope (or Orthicon, for short) has been used to denote these tubes in which the target is operated at cathode potential. (The Greek prefix *orth,* meaning straight, is added to the well known term "Iconoscope" to describe the linear relation between light and signal output, which has been observed.)

● P.E. Scanning Beam

One of the tubes which has been built and tested is illustrated schematically in Fig. 4. A charge image of the scene to be transmitted is developed by focusing the optical image upon a conventional mosaic. The electron beam which scans the mosaic is produced by photoemission from a conducting photocathode, which is illuminated by a flying light spot focused from the face of a cathode-ray tube with a short-time-lag screen. At any instant, the light from a single spot on the cathode-ray-tube screen is focused on the photocathode.

The emitted photoelectrons are guided by the curved lines of flux between the pole faces of an electromagnet, and the beam is also focused by this field. When beam electrons approach a lighted part of the mosaic, they are absorbed and produce signals in the amplifier. From the dark parts of the mosaic the beam electrons are reflected back to the photocathode. Photoemission from the mosaic is collected by the photocathode.

The picture transitted by this tube is quite sharp, and is free from spuri-

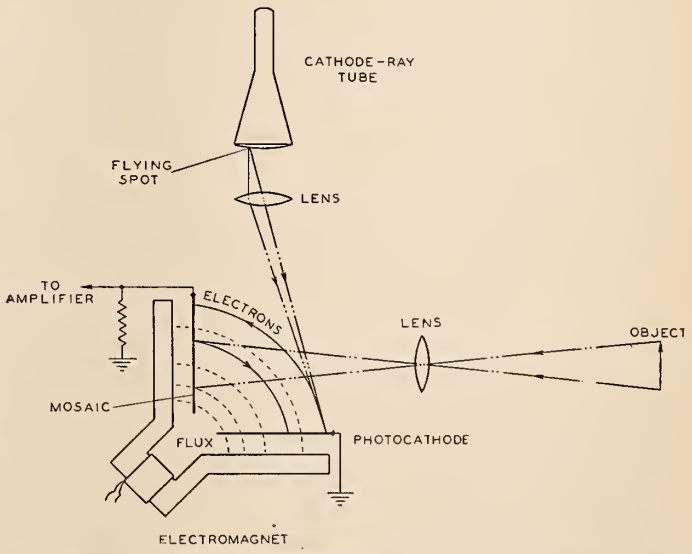


FIGURE 4

Pick-up tube using photo-electrons for beam

ous shading. Streaking, which one might expect because of time lag in the luminescent material, is not apparent. Most of the discharging of charged areas takes place in the first fraction of a microsecond, and after that the beam electrons fail to reach the target and their presence is not observed.

Tubes which incorporate secondary emission amplification of the image, in a fashion somewhat comparable with the method used in the Image Iconoscope, have also been built and tested. Such an arrangement is shown in Fig. 5. In this case, the optical image is focused upon a translucent photocathode and the resulting photoemission is focused up on a two-sided mosaic by means of an axial magnetic field. Secondary electrons released from the mosaic by the high-velocity picture electrons are drawn away to a collecting electrode, giving image amplification.

The electron beam which scans the other side of the mosaic is obtained from a flying light spot moving over another translucent photocathode, and is focused by the same axial magnetic field which focuses the electron image. As in the previous tube, the scanning beam restores the mosaic to the potential of the scanning cathode. When the tube is operated, the gain in sensitivity due to secondary emission amplification is readily observed.

● Thermionic Scanning Beam

While a number of tubes which use photoelectric scanning beams have been tested, these two examples are sufficient to indicate the methods that have been used. These methods make possible the scanning of a large mosaic with a well-focused beam of low-velocity electrons, resulting in the transmission of video signals free from spurious signals. Further, an increase in sensitivity through secondary emission amplification may be obtained. However, because the auxiliary apparatus to generate the flying light spot represented a complication, an investigation was made of tubes in which the beam is derived from a thermionic cathode and is deflected in the presence of a magnetic field.

The most important problem in the design of a pick-up tube, operating with its target at cathode potential and using an electron gun to generate the scanning beam, is that of deflecting the beam without defocusing it. In the case of the tubes described previously, each point on the target had a corresponding point on the photocathode such that the same magnetic line intersected both of them. Photoelectrons generated at one end of the line at the photocathode were focused at the target with substantially one-to-one magnification. A slight enlargement of the scanning spot occurred due to the emission velocities of the photoelectrons transverse to the magnetic field.

If, in some way, larger transverse velocities were introduced into the motion of the beam electrons, they would describe helices of larger amplitude around the magnetic lines and result in a larger spot at the target. In the case of a tube using an electron gun, only the central point on the target is normally connected with the cathode by a magnetic line. If electrons from the gun are to reach other points on the target, either they must cross the magnetic lines of the axial field or they must be guided to other points by warping the axial magnetic field.

Both of these devices are used in the form of Orthicon to be described. To insure, however, that the deflected spot is not larger than the undeflected spot it is necessary that no significant amount of velocity transverse to the magnetic field, imparted to the beam electrons by the deflection system, be retained by the electrons as they approach the target.

The simple electron gun shown in Fig. 6 generates a stream of electrons moving parallel to the axis with a velocity of about 100 volts. The cross-section of the beam is limited to the size of a picture element by the defining aperture in the last electrode. In this state, the beam enters the deflection system and in this state it should emerge except for a displacement from the axis.

The high-speed horizontal deflection is accomplished by a pair of electrostatic deflection plates in combination with the axial magnetic field. A somewhat schematic representation of the path of the beam through the plates is shown in Fig. 7. The beam is seen to be deflected in a plane parallel with the plates and to diverge from the axis only while it is between the plates.

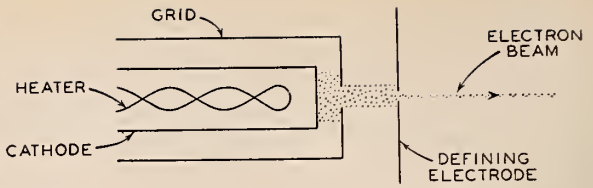


FIGURE 6

Electron gun

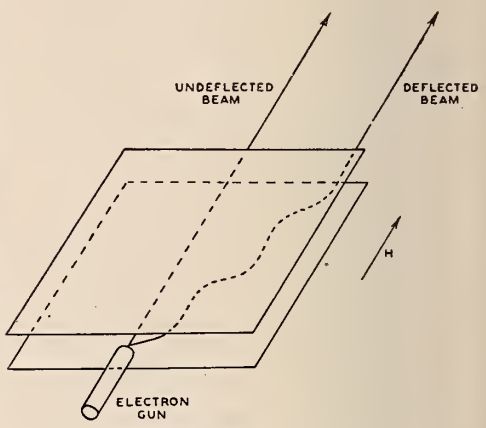


FIGURE 7

Path of electron beam in electric and magnetic fields

After leaving the plates, the beam continues parallel to the axis. The amplitude of deflection is proportional to the electric field and the transit time of the electrons through the plates, and inversely proportional to the strength of the axial magnetic field. Since the maximum amplitude of deflection is limited to the width of plates, these must be as wide as the target to be scanned.

The wiggles in the beam in Fig. 7, when viewed from the end of the plates, that is along the axis, appear as a series of cycloids. This is the two-dimensional path described by electrons moving in crossed electric and magnetic fields. If the electric field from the deflection plates could be sharply cut off at the entrance and exit edges, the transit time of the beam could be adjusted so that only an integral number of cycloids would be performed by the beam in passing through the plates. In this way, none of the transverse velocity represented by the cycloidal motion would be re-

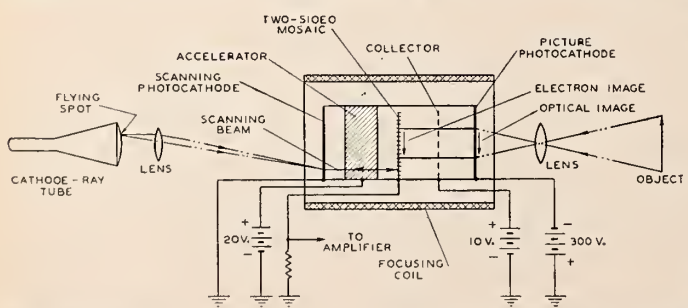


FIGURE 5

Pick-up tube using secondary emission amplification

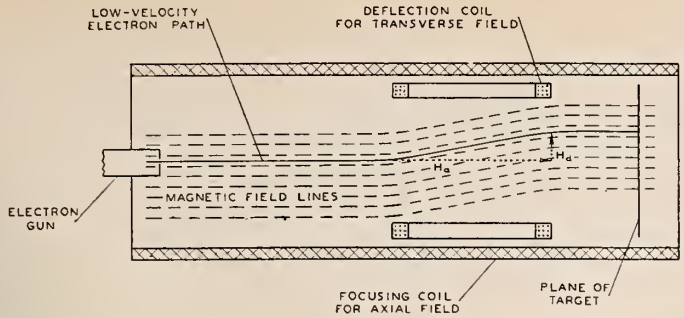


FIGURE 8

Path of electron beam in warped magnetic field

tained by the beam after it left the plates.

While this is a possible arrangement, it has been found that a less critical way of insuring that the emergent beam retains substantially none of the transverse velocity acquired in the plates is to suppress the amplitude of cycloidal motion within the plates. The amplitude of cycloidal motion may be considerably reduced by admitting the beam to the plates through a gradually increasing electric field and similarly letting it leave through a gradually decreasing field. For this reason, the deflection plates are flared out at the entrance and exit ends.

Two significant distinctions are to be noted, in the foregoing account, between electrostatic deflection in the presence of a magnetic field, as in an Orthicon, and electrostatic deflection in a magnetic field free space, as in the usual cathode-ray tube. First, the plane of deflection, which is perpendicular to the plates in the usual electrostatic deflection, has been rotated through 90 degrees into a plane parallel with the plates, in an Orthicon. Second, while the usual plates impart a transverse velocity to the beam which causes the beam to continue to diverge from the axis after leaving the plates, the plates in an Orthicon cause the beam to diverge from the axis only while the beam is between the plates. The axial magnetic field constrains the beam to motion parallel with the axis after it leaves the plates.

The low-speed vertical deflection is accomplished by a pair of magnetic coils. Here, again, while magnetic coils are used in the usual cathode-ray tube without an axial magnetic field, their action in an Orthicon is essentially different by virtue of this field. Briefly, the axial magnetic field rotates the plane of deflection through 90 degrees and causes the electrons in the beam to move parallel to the axis after leaving the deflection coils.

The average path of the beam through a pair of deflection coils immersed in an axial magnetic field is shown in Fig. 8. The amplitude of deflection is proportional to the magnitude and axial length of the deflection field, and inversely proportional to the magnitude of the axial magnetic field. From Fig. 8, it is evident that the separation of the coils must be as large as the height of the target to be scanned.

While Fig. 8 shows the average path of the beam to follow the magnetic lines closely, the actual path contains a helical motion imparted to the electrons due to their passing through a curved magnetic field. For small deflections, the amplitude of this helical motion is of the order of, or less than, the helical motion of the electrons due to their emission velocities. The magnetic coils may therefore be considered as a means of displacing the beam from the axis, without contributing any significant transverse velocity to the beam electrons.

The beam, as it leaves the deflection system and approaches the target, is in substantially the same condition as when it left the gun, except that it may be displaced from the axis. Since the target surface is at cathode potential, the beam passes through an electric retarding field sufficient to slow it to

(*Continued on page* 27)

F.C.C. Limited Commercial O.K. for Sept. 1 Highlights Current Television Surge

RULES for television to allow limited commercial operation were adopted by the Federal Communications Commission recently to take effect Sept. 1. Advertising will be permitted in connection with programs for which the cost is borne by sponsors.

The rules which the commission adopted, however, assert that emphasis on the commercial aspects of the operation at the expense of program research is to be avoided. The channels already assigned to television will remain unchanged pending consideration of testimony at the commission's hearing on March 18 on aural broadcasting on frequencies above 25,000 kilocycles.

There will be two groups of stations. Class 1 stations continuing technieal investigations may be allowed to use more than one channel. Others, designed to experiment in program production and technique, will operate in one channel only.

Receiver Obsolescence Scared

The commission suggests the marketing of receivers capable of being adjusted to receive any reasonable change in methods of synchronization or changes in number of frames or lines which may be found practical. Increased size of receiving sets screens, it holds, is essential to widespread public acceptance of television, and continued experiments in the staging and studio aspects of television performances will be necessary.

"That research should not halt and that scientific methods should not be frozen in the present state of the art are fairly to be deducted from the engineering testimony of representatives of the companies represented at the hearing," the commission states, and its report adds:

Technical Advances Seen Needed

"Actual demonstrations to members of the commission indicate the need for further improvement in the technical quality of television. The evidence reveals a substantial possibility that the art may be on the threshold of significant advance.

"We feel that potentially television is of tremendous value to the public generally. Even now there is no reason why those members of the public to whom regular television programs are available, who are conscious of the fluid state of the art, and who are willing to assume the financial risks involved for the obvious benefits of current programs, should not acquire receivers. Nor is it suggested that television broadcasters should be barred from going forward in program production and sponsorship."

TELE NO THREAT TO MOVIES —TO HEAR NBC TELL IT

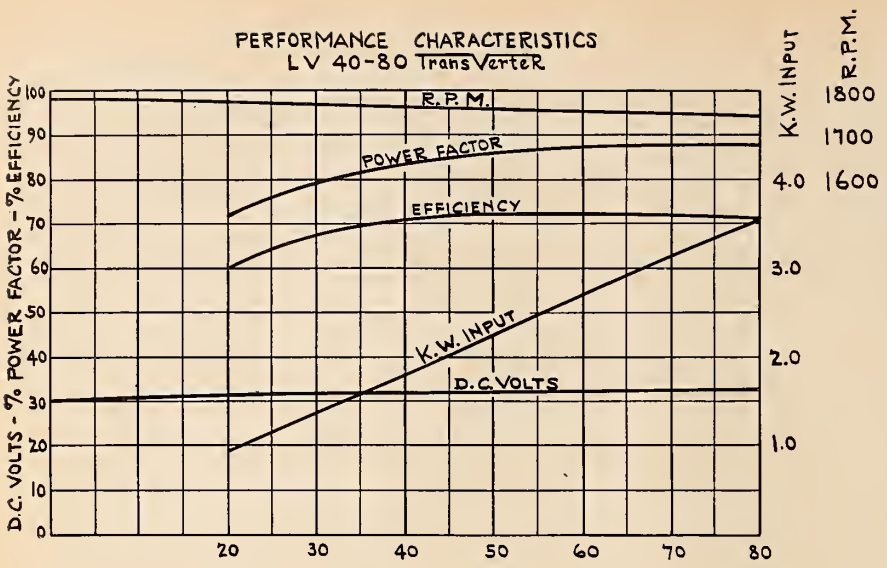
Alfred H. Morton, NBC official in charge of television, recently discounted claims that large-screen television may serve as a threat to the motion picture industry. He said in a formal statement:

"I do not believe that even large-screen television, offers any threat to the motion picture industry. On the contrary, large screen television was developed for the motion picture theatre. It should be the means of attracting wider audiences through the presentation of spectacular news events while these events themselves are in the making.

"As for the threat of home television, I find it impossible to discern any threat to the movies. Mrs. Smith will always put on her hat and coat and go out of the house at least one evening of the week. And the family goes with her. In that is the theatre's guarantee of continued prosperity."

TELEVISION TALENT RATED

In a unique poll of set owners, NBC asked that programs be rated "3" for excellent, "2" for good, "1" for fair, and "0" for poor. The average for all programs was 1.96, just a shade under good. Studio features led with 2.63, special events were next with 2.11, film features were third with 1.96, film shorts, 1.75.



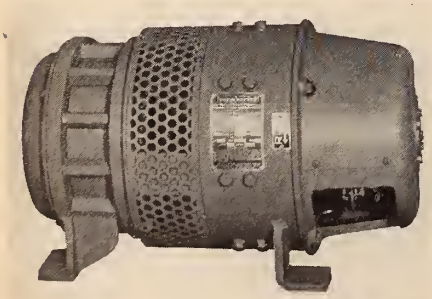
New Hertner 40-Amp. Generator Now Ready

THE new Hertner Transverter for use with the low-voltage, high-intensity "One Kilowatt" arc brought out recently by the National Carbon Co. is now in production and is being delivered. This unit follows the general design of the HI and HIH lines, only being smaller, for while the minimum amperes at which the HI is ordinarily used is 50, this new generator is 40 amperes as a maximum.

The voltage is set at from 32 to 35, which leaves only from 5 to 8 volts ballast drop.

The accompanying curves show an efficiency on one lamp of approximately 72%, not correcting for ballast loss. It should be noted that the ballast losses are quite low because the arc seems to work better on low generator voltages. This is because with a small ballast the increase or decrease in current values from normal whenever the arc varies are more pronounced and assist in restoring the arc to its normal condition.

Extensive tests at the Hertner factory seems to show that a generator voltage of 32 is perfectly satisfactory. Then, with an arc voltage of 27.5, 4.5 volts are used in the ballast and a net efficiency of 60% results. This compares favorably with the efficiency of any other converting device, with the advantages inherent in a motor generator set of reliability, constancy of current, overload capacity, long life under adverse conditions, such as continued high ambient temperatures, as well as freedom from unexpected breakdown.



New Hertner 40-amp. generator

I. A.'s Tele Interest; Select Minneapolis for Meet

Television developments are being watched closely by the I. A. T. S. E., following the decision made at the recent Executive Board meeting in Miami to protect the jurisdictional rights of the Alliance in this field. While it was explicitly stated that the I. A. has no intention of attempting to organize either actors or electricians, all other aspects of the television labor situation will be combed in an effort to place I. A. men in spots where they belong.

I. A. asserts that its A. F. of L. charter covering all labor crafts in the theatrical field protects the organization in all amusement enterprises, including television. Thus, I. A. would battle strenuously to place such workers as cameramen, projectionists and stagehands in the television studios; and it is difficult to see how the television interests could successfully resist such a demand.

Minneapolis was selected as the convention city, beginning June 2 and running several days. Arrangements for the convention are already under way, under the direction of Louis Krouse.

'One-Kilowatt Arc' Is Name of New Low-Wattage Lamps

THE generic term "One Kilowatt High-Intensity Arc" has been applied to the new low-wattage arc lamps now available to the smaller theatres, as being indicative of the economy of these units, according to a communication from National Carbon Co. Stating that these new arcs bring all the advantages of high-intensity, high-efficiency screen illumination to the small theatres at a cost that is well within their reach, the communication continues:

While the "Suprex-type" lamps, developed several years ago, broadened the field of high-intensity screen illumination to include a large number of medium-size theatres, many owners of small theatres felt that the cost of such equipment and its operation was still beyond their reach and consequently continued the use of low-intensity projection with its yellowish screen light.

The result of a careful analysis of the projection light requirements of the smaller theatres led to the development of these new One-Kilowatt high-intensity light sources which now provide the same high level and quality of screen illumination as is used in the larger theatres. These light sources are keyed to the requirements of the modern black-and-white as well as color films, and are available in both a.c. and d.c. types. They present unusual features of simplicity and economy of operation.

Coincident with the development of the lamps themselves, National Carbon Co. lent its full cooperation in the application of its "Suprex" and "Orotip" carbons to fully meet the operating requirements of these new lamps. A new negative carbon, 6 mm. in diameter, known as the "Orotip" C has been especially developed for use in conjunction with a 7 mm. positive "Suprex" carbon in the new Strong Utility and Simplex d.c. lamps. The 7 mm. x 14" "Suprex" carbons are used in the new Ashcraft "Cyclex" lamp. These carbons are all copper-coated, of small diameter, and have exceptional life and light-producing qualities.

These latest developments in projection light sources give the small theatre, with screens up to 18 foot width, a very economical source of snow-white projection light, a high level of screen illumination and perfect color reproduction. With high-intensity projection thus made universally available to all theatres, large and small, a great forward step has been made in providing the means for more comfortable vision, better projection and increased satisfaction to theatre audiences.

Push-Pull Ultra-Violet Recording

A RESUME OF THE RCA PHOTOPHONE SYSTEM OF SOUND-ON-FILM RECORDING

Some uncertainty exists in the minds of not a few projectionists relative to the meaning of the terms "push-pull" and "ultra-violet recording" relative to sound-on-film prints, judged by a reading of various letters received by I. P. Therefore, the accompanying article, relating to the RCA recording method, should be particularly helpful in clearing up any misunderstanding as to the proper use of these terms.

FUNDAMENTAL frequencies lie in the range of from 40 to 5000 cycles per second, overtones from 80 cycles per second upward beyond the audible range. For sound comparable to the original, then, it is necessary to record and reproduce all of the fundamental frequencies and most of the overtones uniformly (40 to 10,000 cycles per second).

It is difficult to determine after listening to any particular quality of sound for a period of time whether the quality of that sound is good or poor. Unfortunately a direct comparison is seldom possible. A number of effects are of interest, however, in determining whether you are listening to high-fidelity type sound or poor sound:

● Evaluating Quality

Can you easily distinguish voices without too closely observing the lip motion? Can you recognize well-known voices? Can you hear all of the instruments in the orchestra? Are you listening to a jumble of instruments or a 10- or 40-piece orchestra? Can you hear the wire brushes and cymbals, only possible if the higher frequencies are present? Can you clearly hear the bass viol and bass horn? Also the percussion instruments?

If the higher frequencies are present the sound seems to come right from the surface of the picture sheet, which is a proper illusion since that is where the photographic image is projected. Lack of these higher frequencies causes the sound to seem to come from some distance in back of the screen, which is wrong. Think of these effects the next time you hear a sound motion picture and determine for yourself whether it is good or poor sound quality.

The second important requirement is that of volume range or dynamics. One of the most important means that a composer of music has to convey his musical thought to his hearers is by means of a gradation of volume. If this effect is to be brought to the theatre patron, a volume range comparable to the original is necessary. To achieve this means noiseless recordings, reproduced so that the softest sounds can be clearly heard without extraneous or interfering sounds and then the loudest sounds without overload or distortion. Two important recording developments have contributed to the accomplishment of this requirement.

● Push-Pull Recording

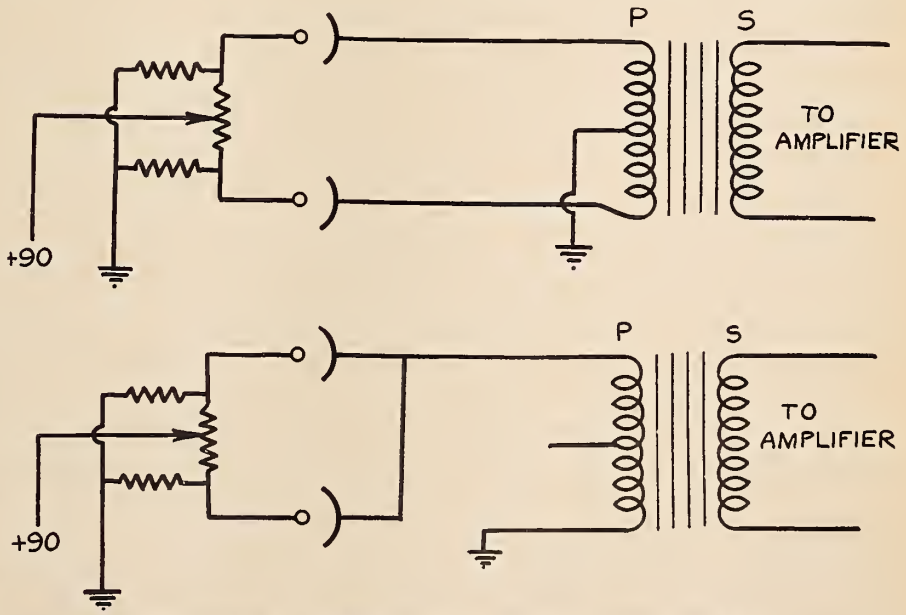
One of these developments is known as push-pull recording. This involves the use of two separate sound tracks occupying the space on the film of the standard track: one for the positive halves of the waves, the other for the negative halves. This is accomplished through the use of a special mask in the recorder optical system. To reproduce this, some modifications must be made to the soundhead, relatively simple on the rotary stabilizer type.

The track is scanned by the same beam of light, resulting in two beams of varying light waves. Each is converted to electrical waves separately by separate photocell cathodes and then electrically connected in a proper phase relationship. The result is a theoretical minimum of exposed track and the cancellation of some types of distortion, permitting an extended volume range.

The second development has perfected this extended volume range over the entire frequency range:

Until comparatively recently high-pitched voices of our favorite actors and actresses have sounded sharp-edged, especially in pronouncing the sibilants such as the letter *s*, which has been the most difficult of all. In addition, the high frequency overtones of certain musical instruments have not been clear and well defined.

These factors have long presented a difficult problem to sound recording engineers, and are caused by our inability to obtain sharp photographs of the high-frequency portion of the sound track. These harsh sound effects are caused by the fact that in ordinary recording and printing methods the very minute variations in amplitude, of which the upper frequency tones are composed, are blurred or distorted in



Comparison of circuits: above, push-pull; below, standard

the sound track so that instead of an exact pattern of speech or music characteristics, there is merely an approximation.

Attempts to overcome this have been made by compensating recording amplifiers, at the same time making the processing of the film extremely critical. The problem has been to find a simple, efficient means of obtaining a clear, sharp photograph of the high frequency portion of the sound track.

● Light Action on Film

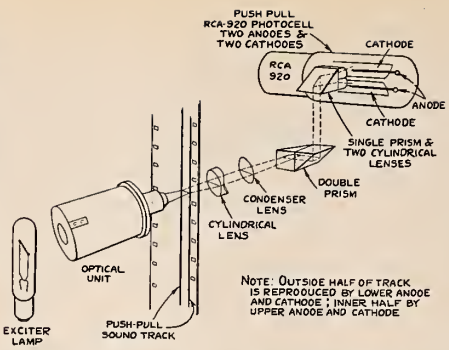
Ordinary white light is composed of a great many different wave-lengths of light. It is impracticable to focus more than two wave-lengths of light sharply at one time. The use of white light, therefore, results in many of the wave-lengths being somewhat out of focus, and blurring the edges of the sound image.

The particular wave-lengths of light which compose white light are dispersed by the film grains of the emulsion in such a way that film grains not in the path of the original recording light beam are exposed. These particular frequencies of light also reach the film surface under the emulsion and are reflected back, likewise exposing film grains not in the path of the original recording light.

The solution to this problem was finally found in ultra-violet light recording. The use of ultra-violet light, which is composed of a very narrow range of wave-lengths of light, eliminates all of the distortion and sharpens the image of the high frequencies. This is accomplished by eliminating all out-of-focus light in the photographing process through the use of sufficiently few wave-lengths of light which can be sharply focussed in a single plane. The particular frequencies of light thus used do not disperse in the emulsion and are absorbed by the emulsion to such a degree that they do not reach the surface of the film under emulsion, thereby eliminating all reflection. The use, therefore, of ultra-violet light, by filtering out all of the white light in the optical system, permits the highest quality recording with clean, sharp, high frequencies materially increasing the naturalness of the recorded sound.

● Vastly Improved Sound

In sound reproduction ultra-violet light recording means that the lisping and hissing effects which mar the speaking voices of many actors and actresses will be completely eliminated, and the quality of musical reproduction brought closer than ever before to a faithful replica of the original. This type of recording can be reproduced



Optical system for push-pull sound reproduction

on any theatre system without modification. However, a high quality reproducer with ample power-handling capacity is required for best results.

Theatres can best take advantage of this technical advance through the use of high-fidelity reproducing systems, employing rotary stabilizer soundheads, a.c.-operated, high-powered amplifiers, and two-way loudspeakers of ample power handling capacity.

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8 Academy Awards for Technical Advances

EIGHT honorable mention awards for scientific or technical achievement were included in the recent crop of awards granted by the Academy of M. P. Arts & Sciences for distinguished contributions to the progress of the motion picture art. These awards, as announced by the Research Council follow:

George Anderson of the Warner Studios, for an improved positive head for sun arcs.

The positive head for sun arcs is an improved, simplified equipment for holding and feeding the positive carbon in an arc lamp. This mechanism produces a steadier and quieter light.

John Arnold of the M-G-M Studio for the M-G-M mobile camera crane.

This new camera crane, because of its unique flexibility, permits the camera to be maneuvered rapidly, easily and silently, thereby supplanting the conventional type camera mounting. This equipment includes a number of novel features.

Thomas T. Moulton, Fred Albin, and the sound department of the Samuel Goldwyn studios, for the origination and the application of the delta db test to sound recording.

The Delta db Test is an effective dynamic method of determining best possible processing of variable density sound tracks. Since accurate processing is vital to sound quality, this test is an important contribution to recording.

Chemical Analysis of Film Solutions

Emery Huse and Ralph B. Atkinson, of Eastman Kodak Co., for their specifications for chemical analysis of photographic developers and fixing baths.

These specifications gave to the industry the first complete, rapid and practicable method for analyzing photographic developing and fixing solutions. The importance and practicability of the specifications has been evidenced by the fact that they have now been generally adopted throughout the industry.

Farciot Edouart, Joseph E. Robbins, William Rudolph, and Paramount Pictures for the design and construction of a quiet portable treadmill.

This treadmill, because of its portability and quiet operation, may be used in a wide variety of scenes and at a wide variety of speeds, with a minimum of restriction to recording.

Harold Nye of the Warner studios, for a miniature incandescent spot lamp.

The miniature incandescent spot lamp is a small, powerful source of light which may be concealed in the set or mounted on the camera matte box without upsetting camera balance, and is therefore an improtant contribution to cinematography.

A. J. Tondreau of the Warner studios, for the design and manufacture of an improved sound track printer.

This printer incorporates features which have not previously been utilized in the printing of recorded sound track, affording greater accuracy of track placement, better definition and improved quality.

Improved Process Projection Units

For important contributions in the cooperative development of new improved process projection equipment to F. R. Abbott, Haller Belt, Alan Cook, and the Bausch & Lomb Optical Co. for faster projection lenses;

The Mitchell Camera Co. for a new type process projection head;

Mole-Richardson Co. for a new type automatically controlled projection arc lamp;

Charles Handley, David Joy, and the National Carbon Co. for improved and more stable high-intensity carbons;

Winton Hoch and the Technicolor Corp. for an auxiliary optical system;

Don Musgrave and Selznick Pictures, for pioneering in the use of the coordinated equipment in the production "Gone With The Wind".

This cooperative development improves the already invaluable process projection method, which in the past has been largely limited by insufficient light intensity and screen size. This development is a definite step toward overcoming past deficiencies. The resulting improvement in quality permits wider use and increased flexibility, thus greatly expanding the scope and possibilities of process projection.

NICKEL-IN-SLOT MOVIES

Delivery of nickel-in-slot projectors will start within 90 days, it was learned recently following conferences here between James Roosevelt and H. W. Banks of Globe Production and execs. of the Mills Novelty Co. Globe will produce the shorts which the projectors, manufactured by Mills, will use.

Intense opposition of exhibitors and Labor in the picture business to this scheme has thus far been unproductive of any lag in preparations.

Chicago Projectionists Union Local 110 has announced that it will claim supervision over the operation of the 16 mm. machines used in the Roosevelt-Globe-Mills deal.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

PROJECTIONISTS are asked to cooperate with RCA field engineers in their educational program to put over the story of presenting all film productions with the correct dynamic range. The importance of having certain "spectacle" sequences reproduced with correct loudness to bring out the full realism and dramatic effects should be understood by all theatre personnel.

Although exhibitors have spent freely for new equipment with greater power-handling capacity, and for power increase modernizations, in too many cases the full benefit of this added power handling capacity is not utilized because the projectionist is signalled for less volume during scenes which should be loud if the emotional effects desired by the director are to be inspired in the audience.

Hollywood's efforts to bring more realism to the screen are lost if we hold the volume level constant through all scenes, as was necessary with the older low-power systems, which needed almost the full power output for the reproduction of scenes which had only average loudness in real life.

Since managers and their assistants rely heavily upon the advice of their projectionists, the latter are in a key position to put over such progressive movements looking toward further improvements in the reaction of audiences towards modern presentations.

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More cold weather news. Up in Columbus, Ohio, Altec Inspector R. S. Merchant received a hurried call for help from the Linden Theatre because the W.E. KS-5259 motor generator would not run.

The generator was located in an unheated room, so the Altecman surmised that the extreme cold had thickened the grease in the bearings to such an extent that the motor would not turn over.

Everybody knows how hard it is to start an automobile after it has stood for some hours in sub-zero weather. Inspector Merchant called for a long rope. He wrapped the rope around the motor shaft, spun the armature as fast as he could, and then slapped on the power. Thus another homely but highly effective trick was devised.

B. A. Susan, RCA field engineer, headquartered at Tulsa, Okla. suggests the following method of re-cementing glass oil level sights in an intermittent movement. First, remove the movement and clean the glass and cover grooves thoroughly with a carbon-tet cleaning fluid. All traces of oil must be removed and the parts left perfectly dry. Now apply a thin coat of ordinary water glass (sodium silicate) to the case grooves and allow to set slightly.

Press the glass in and apply a coat of water glass around the edge of contact, weight the glass slightly and allow to dry. Turn the case over and apply a generous coat of water glass at the contact edges of the glass and case on this side and allow to dry.

The glass sight should not be completely covered with the sodium silicate as it will discolor in time. According to Susan, such a repair will last several years. This suggestion does not apply to celluloid oil sights.

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An epidemic of appendectomies descended on Altec inspectors this month, putting A. A. Ward of New Jersey, E. J. Townsend of New York, and M. O. Overmire of Seattle on hospital operating tables.

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Every projectionist should be acquainted with that part of the picture equipment proper which most commonly causes trouble in sound reproduction. That part is the relay of the arc feed mechanism.

When the contacts of this relay become corroded and spark excessively, or when the small condenser which is often shunted across these contacts become defective, a loud click invariably will be introduced into the sound system every time the relay operates.

Make this relay a part of every routine maintenance program.

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Newspaper reports of excessive winter weather in the deep South were not exaggerated. Altec Inspector P. J. Aubry, whose territory skirts part of the Gulf of Mexico, answered an emergency call on January 26th at the Cullman Theatre, Cullman, Ala. The theatre manager reported that the equipment would not operate, apparently because it was covered with snow.

Inspector Aubry found that the exact point of failure was in the power unit which had become soaked when the snow began to melt. The power unit was dried out by application of an electric heater. Then it worked as good as new.

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For those motor brushes which are such a source of bother, Altec inspector F. J. Pfeiff recommends that "a globule" of "hard" solder applied to contact discs minimizes twisting and has given no trouble from burning.

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Jim Ware, RCA field engineer with the Pittsburgh District, submits the following clever ideas he has observed projectionists in his territory put to good use:

"Here is a very inexpensive method of keeping your reel bands out of the way and in order. Purchase a number of ordinary spring-hinged clothes pins from your favorite 'five-and-ten'. Drill a hole in the upper part of one of the halves to clear a small wood screw to be used for mounting the pin on a board. Fasten the board on the wall near rewind bench. Now place eyelet end of reel bands in clothes pins, thus keeping the strings off the floor.

"When assembling trailers and lining up the program for a new show, one projectionist keeps an eye on the screen, so to speak, by means of the following simple installation. A small ½" x ½" (or smaller) mirror is suspended in the projected image at each projector porthole so that it reflects the image on one of the projection room walls where it can be conveniently viewed. The mirrors are suspended with a fine steel wire. The light loss is not noticeable if the mirrors are small and properly placed."

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Know your equipment, is a good axiom for every craftsman. Don't be mislead by symptoms in trying to trace the *primary cause*. For instance, Altec inspector D. Swanagan recently answered a call from a Chicago theatre asking for help in clearing trouble with the arc lamp power supply.

The trouble consisted of inability to

turn off the arc lamp. The projectionist, jumping at the obvious, had assumed that the trouble was in the On-and-Off tumbler switch, and had torn this switch down in an effort to locate the trouble. This move proved fruitless. Meanwhile he was having to run out into an adjacent room and pull the main three-phase power supply switch whenever he wanted to shut off the arc lamp.

The Altec inspector found that the trouble was burned contacts on the relay which controlled the power to the arc rectifier. The contacts were stuck together, so that the relay would not open when the On-and-Off switch was operated.

To repeat, know your equipment. When a switch fails to accomplish its normal operation, do not jump to the conclusion that the switch is at fault, but consider whether it in turn operates a relay or some other equipment which in turn controls the final result.

• • •

ALTEC Inspector L. W. Chansky, speaking from rich experience gained through ten years of servicing sound systems in the mid-West, warns that "run down" ventilating and cooling systems are common contributors to poor sound reproduction. He further soliloquizes that it will be "only a couple more months until exhibitors begin to think about their cooling plants, so now is a good time to point out that ventilating systems sometimes get noisy, introducing rattles, thumps, *etc.* Correct these conditions now before the sound system gets blamed unfairly".

Going further into his recollection of sound reproduction ills, Altecman Chansky advises: "Particularly the 'blower type' system are the worst enemies of good sound. Some of the things I have run across in inspecting these systems that cause undue noises are: A flat bearing on the main shaft of the squirrel-type fan; this causes a thump. Loose belts that drive the blowers quite often cause a slap which is transmitted into the auditorium; a defective spot weld of one of the blades of the squirrel-cage-type fan causes a tinny rattle; a square piece of duct work (tin) branching off into a round duct tends to cause a disagreeable roar; loose deflecting louvers in the grills in auditorium (particularly if made of metal) will rattle."

Needless to say, a blower and its drive motor should be located some distance from the opening grills, and both should be cushioned by mounting on a cork bed or equal sound insulation.

Last year a rattle in the washed air system at the Lee Theatre, Dixon, Ill., was traced to loose tie rods and louvers in the air washing chamber itself. At the Palace Theatre in Cambridge, Ill., the exhibitor rebuilt his entire duct system using Celotex. Previous to that time his cooling system was practically useless because of noise.

Too small size ducts with big blowers that really move air invariably set up a high noise level in form of an air rush due to too great a pressure. Small size ducts are fine if you have enough of them (such as the "mushroom" system) where the duct is coupled to the mouth or output of the blower. It is preferable to insulate the duct from the fan or blower housing by making the last 6" of the duct out of heavy canvas.

Also, don't forget that a noisy ventilating system makes it necessary that the sound be run at higher volume, which may cause overload and all the symptoms of an undersized sound system.

• • •

RCA field engineer, K. P. Haywood, of the Baltimore, Md. area says: "It has been noted that many projectionists check projector and soundhead threading by snapping the drive motor starting switch on and off in quick succession. This is not good practice, since it places an excessive load on the switch. The average soundhead drive motor will draw more than 20 amperes on starting. This current gradually drops off to about 2.5 amperes as the motor comes up to speed.

"If the switch is opened before running speed is reached, it may be called upon to break many times the normal current. The severe arcing, which occurs under this condition leads to contact troubles and short life. All modern soundheads have a framing wheel on the motor shaft which can be used to turn the projector over by hand to check framing".

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It is a well-known fact that as people grow old their sensitivity to the higher frequency sounds become dulled.

Altec servicemen have taken this fact into consideration in equalizing sound systems in certain southern California communities which have a high percentage of elderly, retired people. The system is adjusted to peak the high end of the frequency spectrum so as to compensate for the reduced sensitivity of the elderly ear. Altec reports that this practice has met with enthusiastic approval.

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"Only a piece of string is needed to properly align a projection lamp with the lens," says field engineer B. A. Susan of RCA's Dallas District and here is how it is done: Remove carbons and projection lens first, then block open the projector fire shutter. Tie one end of a string to the negative carbon holder so that it leaves the exact center of the holder as the string is passed through the positive carbon jaw of the lamp, the lamp cone, projecture aperture, and lens holder.

Now tie the loose end of the string to the shutter blade in such a position that the string is centered in the lens holder. The string can be stretched tightly by backing up the negative carbon holder with the feed handle. After these procedures have been completed, move the lamp or lamp bed so that the string passes through the center of the positive carbon holder, light aperture and lens holder, bringing the entire optical train in line.

If the projector has no front shutter, a piece of wood can be used to span the lens hole in the front of the casing.

• • •

Generally speaking, architects and contractors are now doing a pretty good job in the construction of projection rooms. However, if field engineers and projectionists would offer their services at the time the projection room is being planned, a lot of expensive changes and improper construction could be prevented.

RCA engineer A. F. Schneider of the Kansas City District recently arrived at a new theatre job just in time to prevent the construction of a 7′ x 7′ projection room. Which reminds us—how many newly constructed theatres today have made provisions for concealing sound reenforcement (PA) speakers?

• • •

Believe it or not section! Altec advises that W.E. photo-electric cells, like liquor, actually improve with age. Strange as it seems, this is a fact. Exhaustive tests of a large quantity of both new and old W.E. 3-A, 6-A, and 7-A photo-electric cells disclosed that old cells which have been in service for several years actually average 5 db higher in output.

That this might be the case was not entirely unsuspected since the Bell Telephone Laboratories reported this unbelievable fact away back in 1930 when the 3-A Cell was first brought out as a replacement of the old potassium 1-A Cell. However, this is the first time that it has been possible to make tests of cells some years old to verify the designer's theories.

The life of these types of photo-electric cells is practically infinite. Altec engigineers report no instances where a cell had to be replaced because of it dropping off in output. Replacements are usually caused by broken leads, broken glass or the need for balancing the output between machines.

• • •

A Louisiana exhibitor called RCA field engineer, G. F. Sandore, the other day and asked him to hurry quick and correct his "raspy" sound. Sandore says, "The exhibitor meant 'ratty' not 'raspy'—the pests had eaten away part of the stage loudspeaker cone". Sandore suggests using a fine mesh chicken wire screen across the front of the loudspeaker openings to keep out the rats.

S.O.S. FOR 'HAMS'

A. G. ("Slim") Petrasek, RCA field engineer at Baltimore, Md., and operator of amateur radio station W3GTN, would like to work a communication schedule with other amateurs who are in some way connected with the theatrical business. Incidentally, "Slim" has just been appointed State Network Control Station for the Maryland and Washington, D. C., Army Amateur Network.

THE ORTHICON: A TELEVISION PICK-UP TUBE

(*Continued from page* 21)

near zero velocity at the target. The target is a thin mica sheet, the side facing the beam being covered with a mosaic of photosensitive elements and the side away from the beam being coated with a translucent conducting film of metal known as the signal plate.

The optical picture is focused on the photosensitive side through the translucent signal plate. The photoelectrons are drawn away from the zero-potential surface to various positive electrodes near the target (see Fig. 9). As described earlier, if the element approached by the beam has been unlighted, the beam electrons will not land on the target, but will be brought to rest near it and be accelerated back away from the target. If the element has been lighted, enough of the beam electrons will land to replace the photoelectrons that have been drawn away during the previous frame time. In this way, the beam maintains the target at cathode potential and generates the video signal.

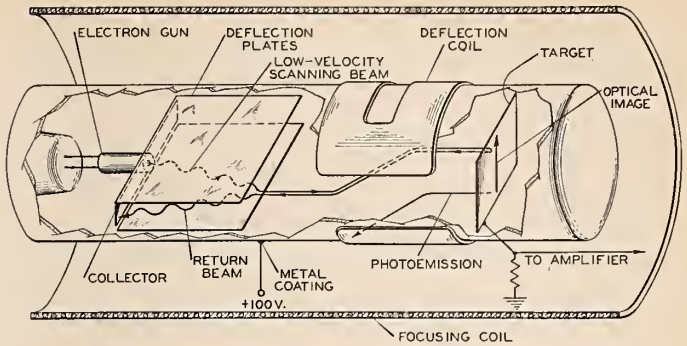
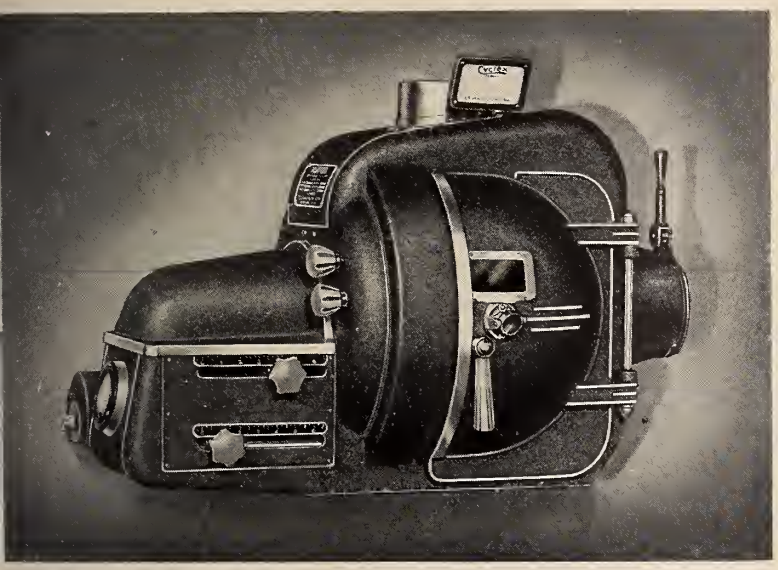


FIGURE 9
Schematic diagram of an Orthicon

The electrons which do not land at the target retrace substantially their original path as they return toward the electrostatic plates. In passing back



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through the plates, the beam diverges from its going path in the direction of the original deflection, as shown in Fig. 9. The beam eventually strikes an elongated collector electrode, also shown in Fig. 9.

● Operating Characteristics

The description of the operation of an Orthicon would lead one to expect a set of simple operating characteristics. This expectation has been borne out by numerous observations on the tubes. Briefly, substantially no signal is transmitted with no light on the target. With an optical picture focused on the target, a signal proportional to the light intensity at each point is transmitted. The maximum signal is limited by the amount of beam current. In some tubes a modulated beam current of one microampere has been observed. This corresponds to a signal current about three hundred times the noise level of a typical television amplifier.

Not only is the transmitted signal proportional to the light on the target, but also the conversion of possible photoemission into signal takes place at substantially 100 per cent efficiency. This requires that the photoemission from the target be saturated throughout the frame time, that the charge be fully stored for that time, and that all of the stored charge be useful in producing a video signal when the scanning beam passes over it.

Tests made on Orthicons have shown that the photoemission from the target is saturated when the collector electrodes surrounding the target are more than twenty volts positive with respect to the target. Since these electrodes are usually about plus one hundred volts, a saturated photocurrent is assured under static conditions. During a frame time, the photoemission from the target is swept over the collecting electrodes by the field from the vertical deflecting coils.

To test whether the photocurrent was saturated equally throughout the frame time and equally stored, a spot of light was projected on the target once a frame time for about one-tenth of the frame time. The signals, both of the photocurrent and of the discharge process, were observed on an oscilloscope. The storage time was varied from zero to a full frame time by varying the time at which the spot was projected on the target. No variation

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in either of these signals was observed throughout the full range of storage time, indicating that the photocurrent was equally saturated and the charge equally stored throughout the frame time.

A final overall test, which compared the transmitted signal with a known amount of light on a target of known photosensitivity, showed that (within ability to measure) all of the stored charge (or by the aforementioned tests, all of the photoemission at the target) was utilized in producing video signal. As a result of this high operating efficiency, Orthicons with a target photosensitivity of one microampere per lumen exhibited approximately the same operating sensitivity as Iconoscopes with a target photosensitivity of ten microamperes per lumen.



FIGURE 10

Observations on the resolution of the transmitted picture showed more than 400-line resolution over the entire picture and as high as 600-line resolution in the center. For the particular size of target used, 2½ inches wide, this means that the scanning beam near zero velocity can resolve elements on the target less than 1/200 of an inch apart.

A representative picture transmitted by an Orthicon is shown in Fig. 10. No shading-compensating signals were introduced into the system from which this picture was taken.

As a result of the tests which have been described, it may be concluded that the operation of a television pick-up tube with its target at cathode potential makes possible (1) the efficient conversion of photoemission into video signals, (2) a large signal output, and (3) the elimination of spurious signals.

MICH. SCHOOLS MUST HAVE BOOTHS FOR 35 mm. FILM

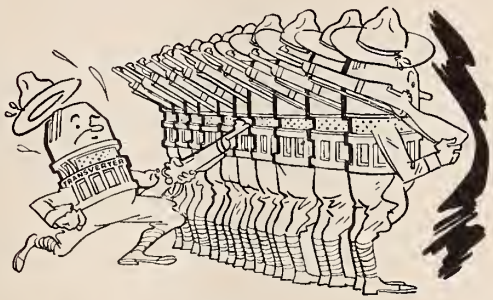
Michigan schools equipped with 35 mm. projectors must have fireproof booths, although schools with 16 mm. and 8 mm. equipment can operate without them provided a competent projectionist is engaged, the State Superintendent of Schools warns in a bulletin.

Whenever admission fees are charged, the building must first be inspected by the State Fire Marshal's office.

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REVAMP S.M.P.E. PROJECTION PRACTICE COMMITTEE

The newly-formed Theatre Engineering Committee of the S.M.P.E. marks another forward step in the activities of the Society. For many years the Projection Practice Committee has studied projection from a practical viewpoint and has issued numerous reports and recommendations of major value to exhibitors and theatre designers.

It has now been recognized that the time was ripe for an even broader study of the problems of theatre engineering. Accordingly, there was formed a new Committee on Theatre Engineering, which will endeavor to investigate all phases of the design, construction and operation of the motion picture theatre. This Committee is under the Chairmanship of Dr. Alfred N. Goldsmith.

Separate Projection and Design

The activities of the Committee will be conducted mainly through two sub-committees. One of these, the sub-committee on Projection Practice will continue the study of problems relating specifically to motion picture film, including matters of projection equipment, projection room design and construction, screens, sound reproducing equipment, and loud speakers together with the related measurement and test methods. This sub-committee is under the Chairmanship of Harry Rubin, Supervisor of Projection for Paramount Theatres.

The sub-committee on Theatre Design will study those features of design and construction of theatres which contribute to better picture quality and entertainment value. This will include seating arrangements, floor contours, wall construction (from both the acoustic and visual viewpoints), and numerous other related matters. This sub-committee will be under the Chairmanship of Ben Schlanger, who has been active as an architect in the field of motion-picture theatre design.

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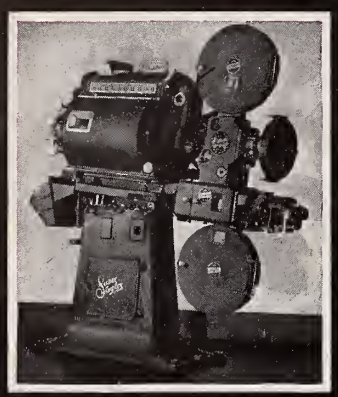
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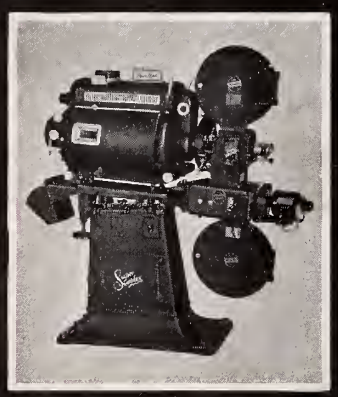
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Edited by James J. Finn

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Monthly Chat

BEFORE us as we pen these lines are copies of two bills for damaged film received by a large projectionist organization in a territory that has long been notorious for the inferior quality of prints released by its film exchanges. There is a great to-do about these bills, the union and the exchange holding to diametrically opposing views as to where the responsibility for the damage rests. Beaucoup trouble will undoubtedly ensue.

All this fussing is wholly unnecessary and could have been avoided by the union through the adoption of a suggestion made in this corner several months ago — a suggestion incidentally, that was adopted by many progressive projectionist units. The idea is this: before each performance the projectionist should examine carefully (not perfunctorily) every foot of film on the program. Any defect, even excess dirt or oil, or both, should be reported to the management *in writing before the show starts*, with a copy being retained for the union's file.

This simple precaution will protect both the projectionist and the union: the former against possible personal injury (the list is long) and the latter against unfair charges for damage. This leaves only one possible "out" for the exchanges—the possibility that film in good condition may be damaged in transit through the projector—our old enemy, defective parts.

This angle, too, offers no insurmountable difficulty. Every union, as a matter of local law, should insist upon periodic examination — say, every six months—of all projection rooms within its jurisdiction. Discovery of seriously defective equipment — particularly in the projector head—should be reported promptly to *both* the theatre and all exchanges in the territory. Under this setup, neither the theatre nor an exchange would be able to harass the union with subsequent bills.

I. P. would welcome the news that several local unions have adopted this procedure. It requires only a few such to start the ball rolling—and to settle finally this vexing problem of responsibility for film damage.

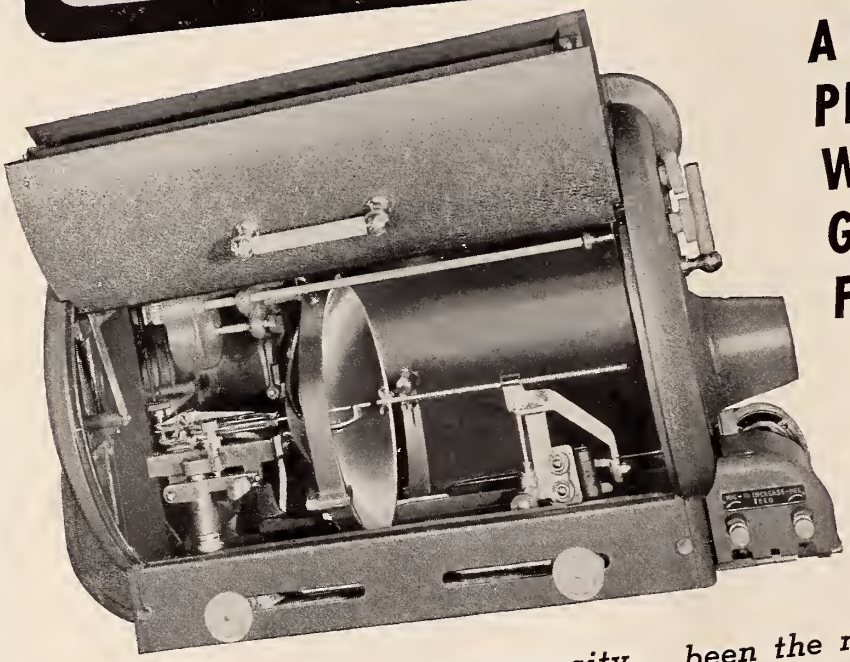
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Any doubt as to the imminence of television broadcasting on a large scale is dispelled by the developments of the past few weeks, even apart from the extremely important news that the F. C. C. has nixed limited commercial licenses on and after Sept. 1. The demonstrations put on by both RCA and Philco (the former even offered color television) for the members of the F. C. C. were most impressive and showed that the art has advanced tremendously since last year.

• • •

Next S.M.P.E. convention will be in Atlantic City, April 22-25. Make it if you possibly can.

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VOLUME XV MARCH 1940 NUMBER 3

Types of Sound-on-Film Recordings

By *ADOLPH GOODMAN*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

THE standard motion picture film for professional use throughout the world today is known as 35 mm. film. This indicates the total width from one edge of the film to the other. The corresponding dimension in inches is 1.378 inches + .000 inches — .002 inches as shown in Fig. 1, which is the standard adopted by the Society of Motion Picture Engineers in Nov., 1934.

There are two general types of material used: nitro-cellulose (inflammable), and cellulose acetate (slow-burning), or as the latter is commonly known, "safety film." The former type is used in commercial films released to theatres by the various motion picture exchanges; while the latter type is used in auditoriums where no projection room is available, and for 8 mm. and 16 mm. film. In general, it can be said that the safety film is employed in non-professional work. All film consists of a cellulose base, one side of which is coated with photographic emulsion. The thickness of the base is approximately 5 mils., and the emulsion coating is about 1 mil. in thickness.

Figure 1 illustrates the S.M.P.E. specifications of the film dimensions, placement of the sound track, and the correct width of the scanned area. It will be noted that the sound track on the positive film is placed to the right of the picture, looking at the emulsion side with the picture viewed upside down just as the film would be threaded in a projector. The width of the scanned area of the sound track is given as .084 inches, or, as it is more commonly called, 84 mils. This means that the length of the light beam focused on the sound track in the soundhead should be 84 mils. The maximum width allowed for the sound track is 100 mils. as shown in Fig. 1.

In the variable-density system the full track is utilized for recording; while in the variable-area method 76 mils. are utilized. As mentioned previously, the length of the scanning beam in the soundhead is specified as 84 mils. regardless of the type of track to be scanned. The reasons for these dimensions are that the edges of the variable density records fade and do not give good contrast, thus making it desirable to cut off 8 mils. on each edge of the track to reduce distortion. In the variable-area track, the scanning beam should cover more than the full modulation of the sound record to make sure that the peaks are not cut off.

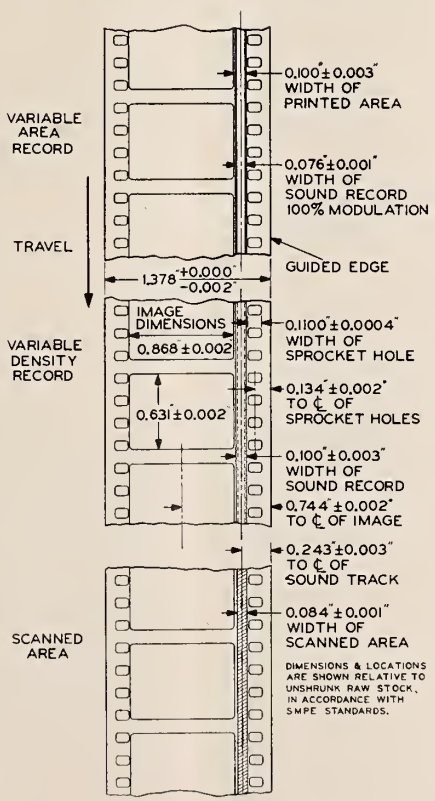


FIGURE 1

35 mm. sound film dimensions

Film will gradually shrink, and this shrinkage is approximately 0.6% for film which has been in use for sometime. This does not affect the picture projection or sound reproduction, as it is so small compared with the total length of the reel of film. However, in the case of a negative which has been used for a considerable period of time there is a serious problem involved when it is used with new stock to make positive prints.

● Types of Recording

Because of the difference in total length for a given number of sprocket holes, the negative and positive film will continually "slip" with respect to each other, when run in a standard contact printer. This will result in a considerable amount of distortion, particularly in the higher frequency range. The "non-slip" printer, first developed by RCA, prevents this type of distortion from being introduced in the printing process.

There are two general types of sound-on-film recording in use today. The



FIGURE 2. *Variable area sound-film track*

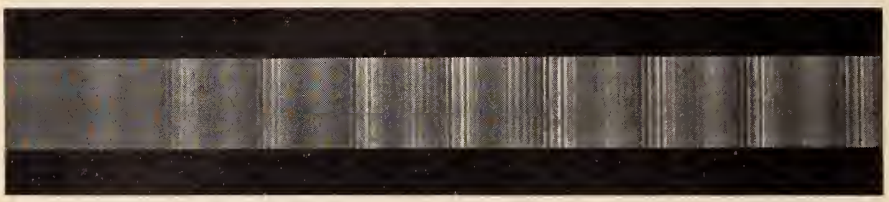


FIGURE 3. *Variable density sound-film track*

first, variable-area, usually is identified with RCA, since it was originally developed and perfected by this company. The other is variable-density, usually identified with Western Electric. However, the RCA systems are easily adaptable for recording variable-density tracks, and one of the major motion picture producing companies now releases density tracks made with RCA recorders.

Both types of recordings achieve the same objective, that is, to vary the amount of light which passes through the track and falls on a photo-sensitive surface, such as that of a phototube. Fig. 2 illustrates a variable-area track, and Fig. 3 a variable-density track.

The important merits of the variable-area system may be summarized as follows:

1. Less distortion, especially for low-frequency and high-amplitude sounds.
2. Less critical to exposure and processing.
3. High phototube output.
4. Less ground noise of "hiss" type, resulting from graininess of the negative and print films.
5. Because the form of the recorded wave may be observed, maladjustments in the recording system or in film processing can be detected more readily.

The original variable-area recording system produced a single trace of sound wave as illustrated in *A*, Fig. 4. The area on one side of the track is black, and the other clear and transparent. In *B* and *C* are illustrated single envelope tracks with ground noise reduction applied in the recording process. The type of track used at the present time in commercial recorders is shown in *D*, Fig. 4. This is known as the RCA duplex variable-area track with ground noise reduction.

Most studios employing the variable-area equipment make original recordings either class "B" push-pull, illustrated in *E*, or class "A" push-pull, shown in *F*. With the class "B" system, it is possible to obtain a better signal-to-noise ratio than that obtainable with any other type of recording. This also means that volume range is greater than with any other type of recording.

Because of the shape of light beams employed, no noise reduction system is required, or, in other words, the method itself is inherently noiseless. This can be seen readily by comparing the exposed areas on the two recordings in *D* and *E*. It will be noted that the exposed area in *E* is considerably less than in *D*, and since the noise depends on total area exposed, it can be understood readily why the track in *E* is superior in this respect.

The tail shown on each light beam in *E* is necessary to give a spread on the emulsion, or to overcome the lack of resolution of the film. By use of this tail, the recordings can be made linear down to zero modulation.

Any rectification of signal due to the recording itself and also even harmonics are cancelled in the primary winding of the phototube push-pull transformer. This system, therefore, is an excellent one for original recordings from which re-recordings can be made.

However, in reproduction of class "B" push-pull recordings in theatres, the soundheads must be very critically adjusted. The push-pull phototube must be very accurately balanced, since each track carries only a half wave. Also, the soundhead must be very finely adjusted to prevent lateral film weave at the scanning point, for the same reason as that mentioned for the phototube.

While the class "A" push-pull recording is not as quiet as class "B," it has the advantage of not requiring such exactness in phototube balance and film tracking in the reproducer soundhead. This is so because each half of the track is a full-wave recording and complete in itself. It has all the other advantages of class "B" recording.

The push-pull recording is not generally used for commercial release prints, but some pictures have been made in which this type recording was employed for reproduction in theatres. To reproduce such tracks, the theatres must be equipped with push-pull heads, which are also capable of reproducing any standard track.

Figure 5 shows a schematic diagram of an optical system used in the RCA recording channels. The light from the exposure lamp is focused on a mirror which is part of the galvanometer. Light from the mirror is reflected through the objective lens barrel, which focuses the light image on the sound track portion of the film.

The galvanometer mirror is made to

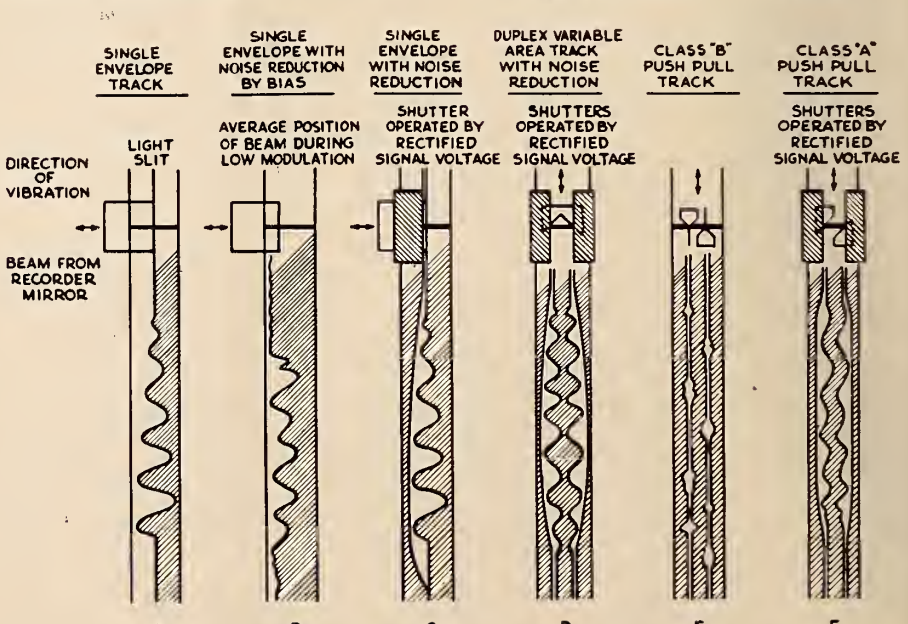
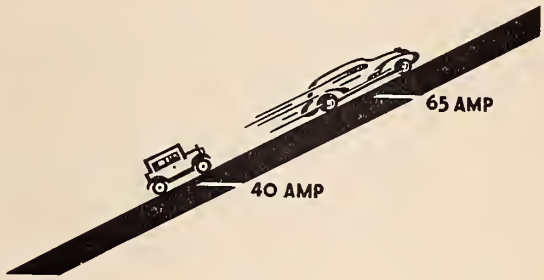


FIGURE 4. *Variable area sound-film tracks*

Let's Face the Facts...



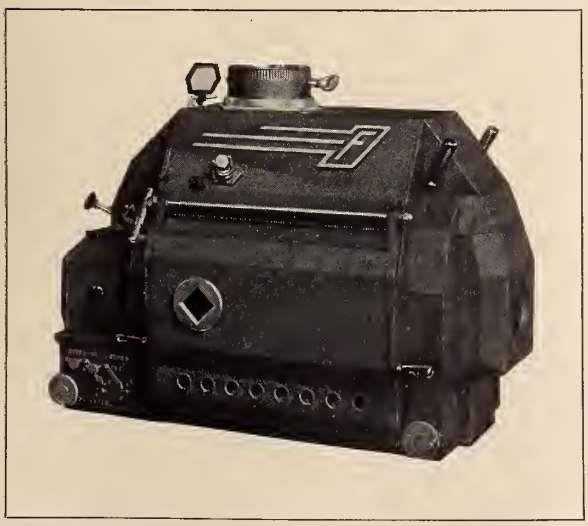
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oscillate in accordance with the sound wave picked up by the microphone. This oscillation is photographed on the film with the result that a record as shown in *D*, Fig. 4 is produced.

The type of the aperture located next to the condenser lens near the exposure lamp determines the shape of light beam focused on the mirror and, therefore, the type of recording finally produced.

A monitoring lens and mirror assembly is incorporated in the system so that the recordist can actually see the average amplitude of the light beam oscillations. In this way a constant check can be made of the operation of the system.

An important factor in recording of high-frequency sounds is the width of the light slit located between the condenser lens and the ultra-violet filter in the objective lens barrel. The slit is 1¾ mils. wide, and the objective lens forms an image of the slit ¼ mil. wide on the film. This is the lowest practical limit for the slit size which can be used and yet allow sufficient light to pass for adequate exposure of the film.

In the early days of sound recording it was very apparent that a considerable amount of background or ground noise was reproduced with the dialogue and music. This noise was particularly annoying during scenes when the dialogue level was low or during scenes when no dialogue or music accompanied the action. This meant that the lowest signal level that could be recorded on film was very definitely limited by the noise and, therefore, the overall volume range that could be recorded was also limited.

The problem and method used to reduce this noise can be understood more quickly by a study of the recording represented by *A* in Fig. 4. With no recording or modulation on the track, one-half is opaque and the other half transparent. This represents a quiet scene on the motion picture screen. However, in the transparent area there are small specks of dirt, grains of silver, or scratches. As these minute specks pass the light beam in the sound reproducing system, they are transmitted through the system as noise. Thus when there is low modulation on the track, the noise due to the aforementioned reasons may be greater than the actual signals.

Since the signal developed in a phototube depends on the *change* of light and not on the *amount* of light, the clear area in the sound track can be reduced considerably without affecting the signal. In Fig. 6, *A* and *B* represent identical signals. Area *X* represents the amount of light which strikes the phototube at a given instant. However, in addition to the recorded signal, the specks in area *X* also change the light falling on the phototube, thus producing unwanted signal or noise.

Now, if area *X* be reduced to area *Y*, then area *Y* represents the amount of light due to the recording which will strike the phototube. In other words, the amount of light passing through the film has been reduced but the change of light remains the same. Since only a small area, *Y*, is now exposed to the light beam, the signal due to noise is reduced.

A scheme for accomplishing the reduction in exposed area is shown in *B*, Fig. 4. Here the zero line of the recording is being constantly shifted. This method was not very satisfactory because of the serious effects of lateral

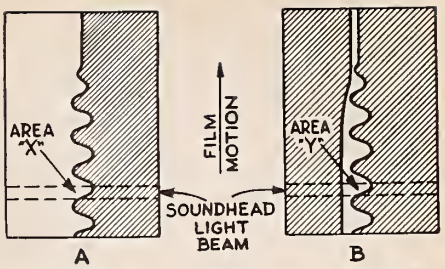


FIGURE 6. *Ground noise reduction*

film weave in soundheads, especially during low modulated signals.

A better method is shown in *C*, Fig. 4. Here, the transparent area is varied so that it just allows sufficient space for the peaks to be properly included. Before the signal voltage reaches the galvanometer, it is fed into a "ground noise reduction amplifier." This amplifier is so arranged that as the signal level decreases, it operates a shutter vane which blocks off a portion of the clear track. As the signal level increases, the shutter vane is moved so that it allows the recorded signals to occupy more space. Thus, the ground noise reduction is accomplished automatically, the signal level determining how much track will be exposed.

The track shown in *D*, Fig. 4 is most commonly used at present in commercial recordings. Here the noise reduction is accomplished by means of two shutter vanes, shown in Fig. 5. When no signal is impressed on the galvanometer, the track consists of two very narrow lines, as shown in *D*, Fig. 4. The instant a signal voltage acts on the galvanometer, the shutters immediately respond by opening a certain amount, depending on the modulation of the signal.

The outstanding advantage of the class "B" push-pull recording is that it requires no auxiliary equipment for ground noise reduction. In *E*, Fig. 4, it can be seen that with no signal or modulation the exposed track consists of two very narrow lines. As the signal is impressed on the galvanometer, the light beams move vertically above and below the slit. When the beams move down, the left side of the track is exposed in accordance with the original sound, and no exposure is produced on the right. As the two beams go upward, the inverse action takes place and thus one-half of each cycle is produced by each light beam.

An examination of the track discloses that no transparent areas, other than the track, is obtained by this method, which means that the noise is consequently greatly reduced. It is for this reason that so many studios use this method for original recordings, after which it is re-recorded, perhaps mixed with other sound effects, for final release in the standard type recording.

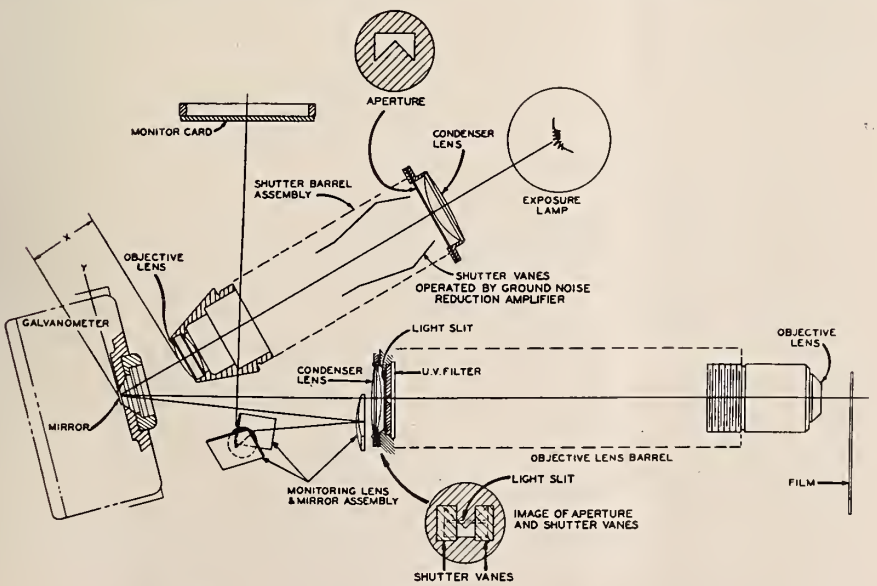


FIGURE 5. *Schematic of RCA recording optical system*

S.M.P.E. Meeting in Atlantic City April 22-25 Offers Varied Papers Program

A VARIED and extremely well balanced program of technical papers on every phase of the motion picture art, as well as on television, is scheduled for the Spring Convention of the Society of Motion Picture Engineers to be held April 22-25 at Haddon Hall, Atlantic City. Of particular appeal to projectionists are the many papers on the practical as well as the theoretical aspects of visual and sound reproduction, including the latest advances in optics, arc lamps, light sources and technique.

So extensive is the papers program that technical sessions will be held each day from 10 a.m. to 6 p.m., excepting Wednesday afternoon, which will be left open for recreation and sightseeing. In addition, one evening session is scheduled, that of Monday, when Dr. M. Luckeish of General Electric will present a paper on lighting.

● Many Projection Papers

Of top interest among the projection papers is one by A. C. Downes, of National Carbon Co., entitled "Products of Combustion of the Carbon Arc," which details the results of extensive and exhaustive investigation upon the question of precisely what happens when carbons are burned within areas approximating the average projection room. Other projection papers include one by Harry Rubin, of Paramount, on projection supervision; that by C. S. Ashcraft anent his new Cyclex projection system; that by T. P. Hover of Lima, Ohio, on safety in projection practice, and one on the correction of projection defects, by I. Gordon, of Akron, Ohio.

The television group will weigh in with at least four papers, to be given by representatives of RCA, NBC, CBS, and the Don Lee organization on the West Coast. The contribution of Messrs. P. Goldmark and John N. Dyer, "Quality in Television Pictures," promises to be particularly interesting because of the wide interest now being displayed in the merits of the television image as compared with that of motion pictures shown in theatres and in the home.

As usual, the papers program will be rounded out by the reports of many committees, which invariably prove of great interest.

The social side of the Convention promises to be as engaging as ever, with the banquet on the evening of the 24th topping the list. Atlantic City offers many recreational opportunities, in addition to its famed climate, and the various committees are planning to exploit them to the fullest. As is customary, a special program has been arranged for the ladies, with Mrs. Oscar Neu acting as official hostess.

Abstracts of those papers which are of interest to projectionists are appended hereto:

CONTROL OF SOUND IN THEATRES AND PREVIEW ROOMS

C. C. Potwin

Electrical Research Products, Inc.

Acoustical science can now be applied to better advantage than ever before in the planning of modern motion picture theatres. A broader understanding of the purposes and principles of acoustical design and treatment is needed, however, to make this application universal. The Society is in a position to do much toward fulfilling this need.

Greater attention should be given to the design and development of the basic theatre structure. The shaping of surfaces for the control of sound reflections is effective and can be kept within a desirable archi-

(*Continued on page* 29)

Distortion Often Caused by Defective Tube in Push-Pull Power Stage

BY THE ENGINEERING DEPARTMENT, ALTEC SERVICE CORPORATION

MANY trouble calls complaining of distortion result from one of the tubes in a push-pull power stage becoming defective. This condition may not be easily detectable because the plate current of the combined stages may show little change. An explanation of this situation follows:

First, there is the fact that the total plate current in a push-pull stage having one defective tube, usually low or no emission or possibly a burnt out filament, may show little change. Most push-pull stages get their grid bias from the voltage drop caused by the combined plate current of both tubes following through a common biasing resistor.

If one tube becomes defective, the total plate current of the stage drops; this drop in plate current, however, immediately causes a decrease in the voltage drop across the common biasing resistor, which lowers the grid bias on the remaining good tube; and, when the grid bias on the good tube is decreased, the plate current on this tube, of course, immediately increases, with the result that the plate current for the push-pull stage (most or all furnished by the good tube alone) will come back until it may almost reach normal. Thus, any one checking the plate current in a push-pull stage having one defective tube might conclude that the stage was operating normally.

Relative to why a defective tube causes distortion:

(*a*) When the plate current on the remaining good tube increases to almost double value, as explained previously, the power-handling capacity of the stage is reduced and non-linear distortion occurs due to the tube operating at an unfavorable point on the plate current characteristic curve.

(*b*) Push-pull transformers are designed to operate without being magnetized. This condition normally holds because the plate supply voltage is applied to the common leg (center tap) from where it branches through the transformer to the outside legs, thus cancelling any tendency to magnetize the transformer except for the smaller effect due to unbalance of tubes.

The transformer is designed to accommodate reasonable unbalance. However, if one of the tubes is defective, the current through one leg of the transformer is nearly twice normal, and since there is no current in the other leg, there is no cancelling effect. As a result, the transformer core saturates, its inductance drops to a low value, the low end of the spectrum is attenuated, the overload point is lowered, and the harmonic content below overload is greatly increased.

(*c*) Furthermore, when two good tubes are working in push-pull they cancel to a large degree the 60-cycle hum developed in that stage. This beneficial effect is killed when one of the tubes becomes defective.

(*d*) If the amplifier has an inductance in the common leg of the output transformer, another cause of distortion and power loss will exist. When both tubes in the push-pull stage are good, they balance each other so that no speech signal comes through the common leg. When one of the tubes becomes defective, the signal passing through the good tube returns through the common leg of the transformer and the high impedance of the inductance in this leg affects the whole upper end of the spectrum.

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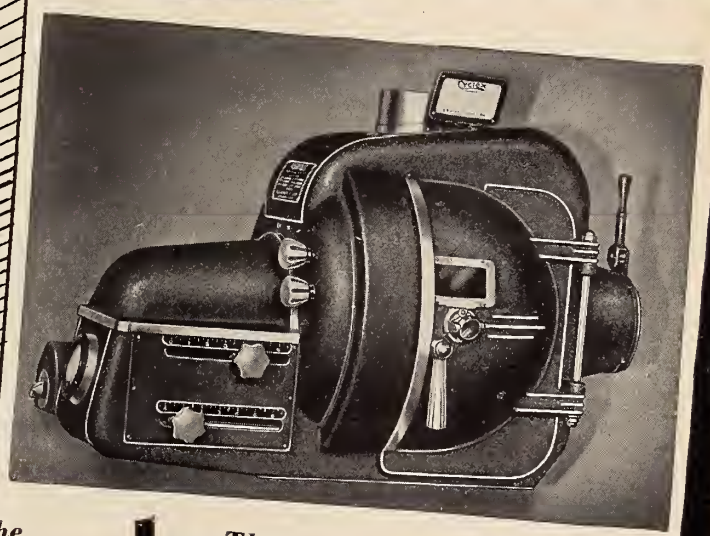


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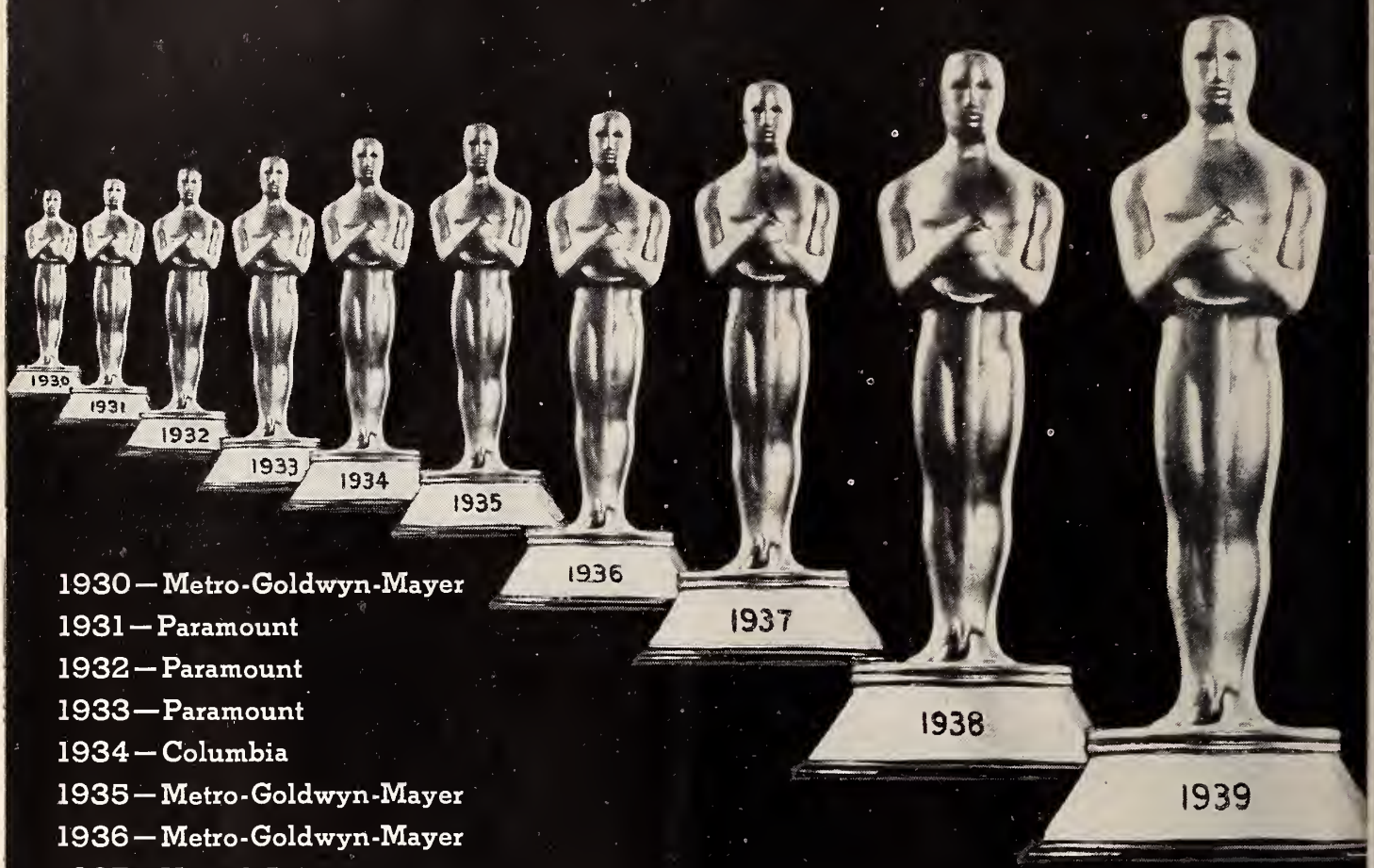
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Air-Cooled, High-Brightness Mercury Vapor Lamps For Motion Picture Projection

BY ENGINEERING DEPARTMENT, GENERAL ELECTRIC COMPANY, LTD., ENGLAND

This article describes the functions of light sources at present used for projection. It is shown that high brightness is usually the most important property of the source. The possible advantages of mercury vapor lamps are discussed, and the characteristics of practical air-cooled lamps is cited. Linear and compact-source types are shown to be practicable, the latter having twenty or more times the brightness of the filament of a tungsten projector lamp.

This article is of the utmost importance to the projectionist who desires to keep abreast of the latest developments in the art.

AS IS generally understood, the projection of light implies the accurate control of light flux, and usually the concentration of flux into some defined and generally small zone. This concentration may serve one of three purposes: either it may produce on an object a higher illumination than would be possible with the bare source alone, as with a floodlight or searchlight; or it may provide a distant visual indication, as with a signalling projector; or it may serve to project a real optical image of an object in the projector, as with an optical lantern or film projector.

There has always been a popular opinion that a "point source" is required for effective projection. There are situations in which a source of small dimensions is desirable, but it will be shown that there are others in which a source of considerable dimensions can be used with advantage; there is probably no optical system for which a point source is essential. The confusion may arise from the fact that for one reason or another a small source has usually a high brightness, and in many projection problems high brightness is the most valuable characteristic of the source.

Any projection apparatus has an aperture from which the light finally emerges. In a floodlight it is the full aperture of the mirror by which the light is reflected directly into the beam; in a lantern slide projector it is the aperture of the image-forming objective lens through which the light finally emerges after traversing other optical components.

The beam intensity is the flux per unit solid angle leaving the projector, and is equal to the product of the brightness of the image of the source and its area as formed in the final aperture and seen from the object illuminated. The brightness of the image is equal to that of the source itself, less the transmission losses of the optical system. In shape, the image is frequently so distorted as to be unrecognizable as an image of the source, and it is usually referred to as the "flashed area."

Since the beam intensity is proportional to the flashed area and to its brightness, it follows that once the aperture is fully flashed, the beam intensity depends solely on the source brightness.

There are types of projectors in which it is difficult, and sometimes impossible, to flash fully the final aperture of the optical system. In such cases source size as well as brightness is usually a factor of importance, and high brightness which is obtained at the expense of size of source is then of little value. There are, nevertheless, many instances in which the full value of a high brightness source can be realized, and developments in new sources of this type are, therefore, of considerable importance.

Up to the present, the sources commonly used for projection have been either tungsten filament lamps or various forms of carbon arc. In Table A are given approximate ranges of brightnesses obtainable with a few well-known sources, the specific values depending on the life, power, and type of individual lamps.

TABLE A

Approximate brightness of sources

Source	Approximate Brightness (Stilb)*
Tungsten filament general lighting service lamps ...	100—1,000
Tungsten filament projector lamps	250—2,000
Pure carbon arc	10,000—25,000
High intensity carbon arc	50,000—100,000

*Candles per sq. cm.

It is seen that the carbon arc has a brightness greatly in excess of that of tungsten filament lamps. For many applications, however, the filament lamp is used because of its simplicity where a higher brightness would be an advantage. There is, therefore, real need for lamps which combine the high brightness of the arc with the simplicity of the filament lamp.

Air-Cooled, High Pressure Mercury Vapor Lamps

The possibilities of the high pressure mercury vapor† discharge as a light source of high luminous efficiency have been realized for many years. In 1906 and 1907 experiments were made with lamps in which the mercury vapour pressure was several hundred millimeters. Since then, until the last six years or so, although many types of lamp were proposed using some form of H.P.M.V. discharge, no major practical application was made.

Within the last decade, however, the high luminous efficiency of these lamps has been fully appreciated and utilized; the general characteristics have been frequently described and are now well known. But it is only within the last year or two that the potentialities of the H.P.M.V. discharge as a high brightness source have been realized.

During the last few years a great deal of work has been done to explore the possibilities in this direction. This work has led to the development of two main classes of lamp. the air-cooled and the water-cooled. It is now known, moreover, that, at least in the laboratory, H.P.M.V. lamps can be made the brightness of which is comparable with that obtainable in any other type of lamp or arc.

In speaking of the brightness of the column of the H.P.M.V. discharge and

†High pressure mercury vapor will be abbreviated as H.P.M.V. throughout the article.

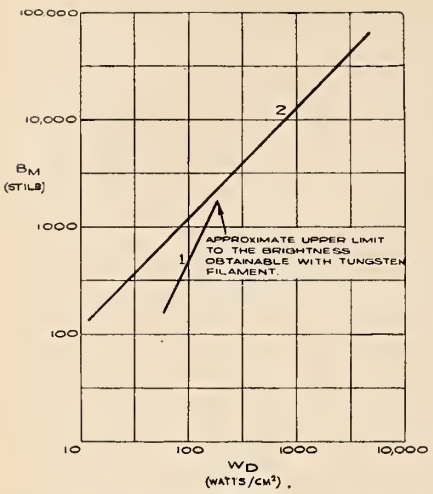


FIGURE 1

Relation between W_D and B_M for H.P.M.V. discharge and for tungsten filaments

(1) Tungsten filaments
(2) H.P.M.V. discharge

comparing it with the brightness of the tungsten filament, certain differences should be borne in mind.

In the first place, the brightness of the tungsten wire is substantially uniform over its surface, whereas the H.P.M.V. discharge column is brightest in the centre and decreases gradually to zero on each side. It is true that in the case of coiled tungsten filament the same effect is also observed, as in the middle of the coil a greater proportion of the tungsten area is composed of the brighter inside of the coils than at the edges; the extent of the effect is, however, less.

The second difference of importance is that tungsten filament lamps, when used for projection purposes usually have the filaments arranged in the form of a grid. Thus, since the bright coils alternate with the dark spaces, the average or effective brightness of a tungsten projector lamp of this type is less than the brightness of the wire itself.

By the term "brightness" is always meant here the maximum brightness, that is to say, in the case of the discharge column the brightness measured in the centre of the arc, and in the case of the filament lamp the brightness of a central area of the coil.

● Practical Possibilities

Within the last year or so, general lighting service H.P.M.V. lamps of 80-watt and 125-watt rating have become available. Although they are usually enclosed in internally frosted outer bulbs, so that the bright discharge column cannot be seen directly, in actual fact the brightness of the column is some 1,000 sb*. The fact that such a high brightness is obtainable in lamps not specially designed for the purpose makes it important to consider what brightness could be obtained in lamps if they *were* so designed.

The brightness of any surface, *e.g.*, the column of a mercury vapour discharge or of a tungsten wire, is determined by the *amount of energy radiated per unit area of that surface in the visible region of the spectrum*, due account being taken of the varying sensitivity of the eye to different wavelengths.

It is easier to consider the total energy dissipated from a surface (*i.e.*, by radiation, convection, *etc.*) than the energy radiated alone, as the former is merely the energy input divided by the surface area. There is clearly a close connection in the case of the filament lamp between the surface brightness and the energy dissipated from the surface, since the brightness of the filament of a lamp increases rapidly as the current through it is increased.

In considering the wattage dissipated per unit area of the surface of a discharge column, a slight difficulty arises since the boundary of the discharge is by no means definite. It is, however, for this purpose, convenient to consider that the boundary of the column occurs where the value of the brightness is equal to half the maximum value.

In Fig. 1 is shown for an extended range the relation between the energy dissipated per sq. cm. of surface (W_d) and the brightness for both tungsten filaments and the H.P.M.V. discharge column. It is seen that both follow roughly the same law, but that the curve for the H.P.M.V. discharge is continued to much higher values of the brightness than that for the tungsten filament. This is because an upper limit to the wattage that can be radiated from the surface of a tungsten wire is set by the rapid increase in the rate of evaporation of the tungsten and consequent shortening of the life of the lamp.

Evaporation from the discharge column of an H.P.M.V. lamp is not a factor which limits the brightness obtainable and, therefore, very much higher values are possible than with tungsten filament lamps.

It is now clear that to obtain high brightness with the H.P.M.V. discharge it is necessary, as with a tungsten filament, to dissipate a large amount of energy from a small surface. This object is achieved in the case of a tungsten filament by increasing the current through it and, as would be expected, this is also a method of increasing the energy dissipated from the H.P.M.V. column. It is, however, necessary to prevent the discharge column from "spreading" as the current is increased, or even to cause it to contract. This is done by using a high pressure of mercury vapour or by making the envelope which encloses the discharge column of narrow bore, or both.

There are other important considerations to be taken into account in the design of H.P.M.V. high-brightness lamps. Among these are the shape of the source and the necessity for providing a motionless column. These considerations, combined with the high brightness requirements, lead to two main types of lamp.

The first type has a long narrow column in which the maximum brightness of the source which can be obtained is limited by the softening point of the material of the envelope. This difficulty has led to the development of water-cooled lamps. Without artificial cooling, however, the use of quartz for the material of the envelope allows a brightness of some 1,000 sb*. to be obtained in lamps which have several hundred hours' life.

The second type of air-cooled H.P.M.V. lamp has an arc length of only a few millimeters. The diameter of the tube is so great compared with the arc length that the shape of the envelope is usually approximately spherical. The watts per cm. of arc in this type can be made so much higher than in the other type that brightnesses of 10-50,000 sb*. can easily be obtained even in lamps of quite low wattage rating. An example of the compact source type in Fig. 2.

● Compact Source Lamp

500-*Watt Type*.—The lamp shown in Fig. 2 is an example of the compact source type in a 500-watt rating. This consists of a quartz inner discharge tube mounted in a hard glass tubular outer bulb. The quartz inner tube is approxi-

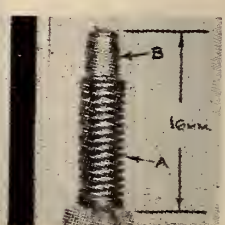


FIGURE 2

Left: 500-watt compact source H.P.M.V. lamp

FIGURE 3

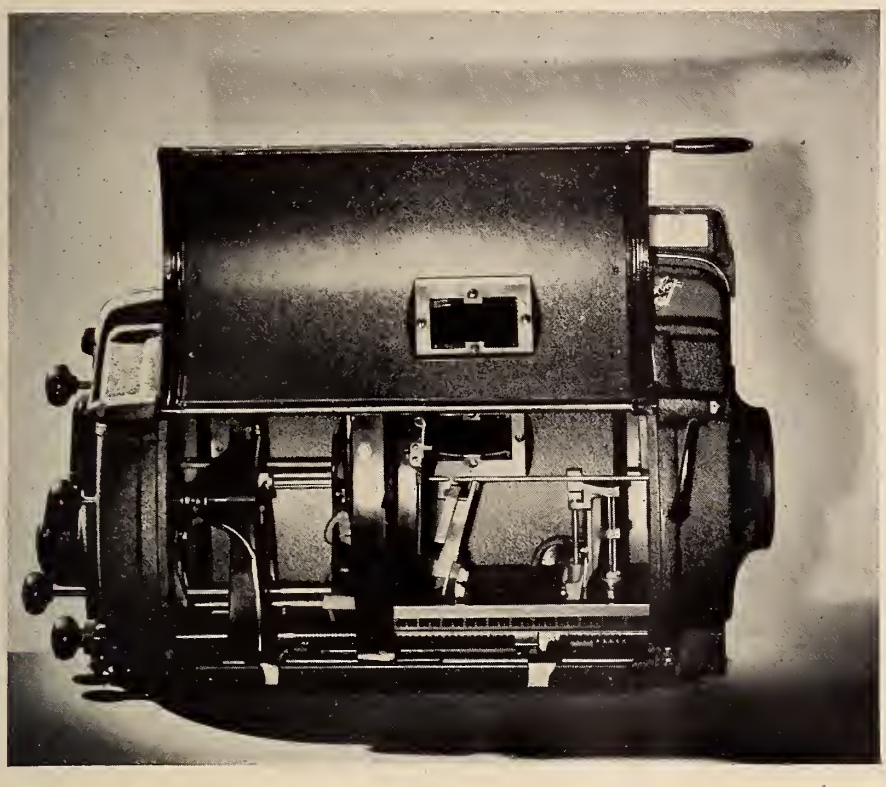
Below: electrode system of 500-watt compact source lamp



*Candles per square centimeter.

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A low cost, high intensity, direct current projection arc of intermediate capacity designed especially for theatres of up to 800 seats and using screens as large as 18 feet in width, heretofore restricted to the use of low intensity lamps, with their dim yellow light, because the operating, if not the original, cost of the earlier high intensities has been prohibitive.

Although the Simplex High projects twice as much light as the low intensity, the over-all operating costs are only slightly higher, because this new arc operates at only 27 volts as compared with 55 volts in the low intensity and each 14-inch, 7 m.m. Suprex positive carbon burns for at least two hours.

This Simplex High projects the snow white light characteristic of the high intensity arc which is so necessary to the projection of colored pictures.

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Does not touch the film or reel.

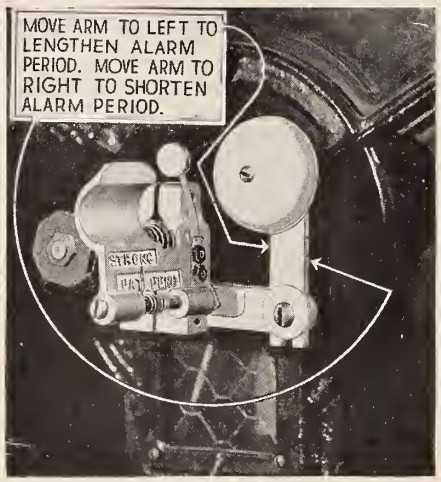
Is strictly mechanical and requires no batteries, no transformers, no governors, and no pre-setting by the projectionist.

Is not dependent upon any change in the normal smooth operation of the projector.

Is installed within 5 minutes, requiring no drilling.

Once installed, forget it—as was conclusively demonstrated by 1200 tests under practical conditions in various projection rooms.

About 75 seconds before the end of the reel the bell begins to ring, continuing distinctly for 15 seconds, after which period of time it ceases. The duration of the bell-signal can be increased or decreased about 15 seconds by simply moving the arm to either the left or the right.



The Strong Reel-End Signal Is

Adjustable

for Either 4- or 5-inch Hubs

PRICE: $8.50 each

Zipper Changeover

ZIPPER Changeovers for all models mount directly on the projector at the aperture and can be installed within 10 minutes without any drilling or tapping, etc., and require no brackets! A new-type treadle foot-switch, utilizing an unbreakable mercury switch, eliminates all switch trouble. Weighs only 20 ounces; guaranteed against trouble for one year after purchase.

The combination Sound-Vision Changeover is now available in all ZIPPER models for use with any RCA sound installation. This method of changeover is EXCLUSIVE with the STRONG ZIPPER, being fully covered under U. S. Patent No. 1,796,970. These combination models for RCA systems are priced at $125 per pair, including foot-switches.

ZIPPER Changeovers available for Simplex (all models) Motiograph (all models) and Kaplan projectors.

●

PRICE ON ALL MODELS

$60 per pair

With Treadle Mercury Switches: $75

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mately spherical in shape with a diameter of about 40 mm. The arc is 5 mm. long. It contains a restricted quantity of mercury and a few millimeters of rare gas to assist starting.

No step-up transformer is necessary in order to operate the lamp, and it is connected directly to the ordinary supply voltage of 200-260 volts through a choke coil. The gear losses may be taken to be some 10 per cent of the lamp wattage, the exact figure varying according to the design of gear and the circuit conditions. Starting takes place in rare gas and only a very low pressure of mercury vapour; about five minutes are needed before it is in its final operating condition. The maximum brightness of the arc is then about 20,000 sb., and the width to half-brightness 2.5 mm. The life of this lamp is 500 hours.

A feature of the construction of the compact source lamp in which it differs from the well-known H.P.M.V. lamps used for general lighting is the special type of electrode system employed. One form is shown in Fig. 3.

As a result of the extremely high values of the watts per cm. of arc in the compact source lamp, the electrodes on which the discharge terminates are held at a very high temperature. In consequence, if the electrode is provided with a store of thermionically active material, as is usual to facilitate starting, this active material evaporates rapidly and causes blackening of the envelope. On the other hand, if no active material is used at all a high voltage is required to start the lamp.

The construction used avoids both these difficulties by separating the electrode on which the discharge *starts* from that on which it *runs* when in the full operating condition. In Fig. 3 A is the starting electrode and contains active material within the tungsten helix shown; B is the running electrode and consists of a solid block of tungsten.

When the discharge starts, the arc terminates on the starting electrode, since this is thermionically active. As the mercury vapour pressure increases, however, and the volts per cm. of arc increase, the discharge finds it easier to terminate on the tungsten electrode B, since the arc length is much less.



FIGURE 4

Compact source lamp; left, just after starting; right, in fully run-up condition

Figure 4 shows a lamp just after it has started when the discharge is terminating on the starting electrode and also when it is in the fully run-up condition. The transfer from the starting to the running electrodes takes place automatically at some period during the run up.

Compact source lamps of higher and lower wattage than 500 watts are being developed in the laboratory. In experimental lamps for any given wattage, a wide range of brightness can be obtained by varying the arc length. So far as can be estimated at present, practical considerations will probably mean that the size of the source will increase with the lamp wattage, so that for lamps of wattage higher than 500 watts it is likely that the source will be both longer and wider than the dimensions given for the 500-watt lamp.

● Arc Brightness Factors

The brightness obtainable in the compact source lamp depends on the wattage, the arc length, and the arc voltage. The arc voltage for a fixed arc length is determined mainly by the pressure in the lamp; the wattage per cm. of arc is the major factor in deciding the brightness, but the pressure also has an effect. In general, increase of either watts per cm. of arc or increase of pressure results in an increase of brightness.

In Fig. 5 is shown for 250-watt, 500-watt, and 1,000-watt lamps how the brightness varies with arc length and lamp wattage, the arc voltage being nearly constant at between 60-75 volts. It will be seen that at short arc lengths the brightness increases very rapidly, and at arc lengths of the order of 1 to 2 mm. very high values can be obtained.

Theoretical considerations would indeed suggest that the upper limit to the brightness obtainable in the mercury vapour arc lies far above the values mentioned in this article.

● Color of Light

For the projection of colored films and lantern slides the color of the light is an important consideration. It is well known that the H.P.M.V. discharge is deficient in red, and to a lesser extent in blue. This deficiency is the primary, although not the only, problem in connection with the suitability of these lamps for the projection of color films and slides.

The lack of red becomes less with increasing pressure and increasing current density. Since these two factors are associated with increasing brightness, it would be expected that the high brightness lamps have a higher proportion of red radiation than the general lighting service lamps.

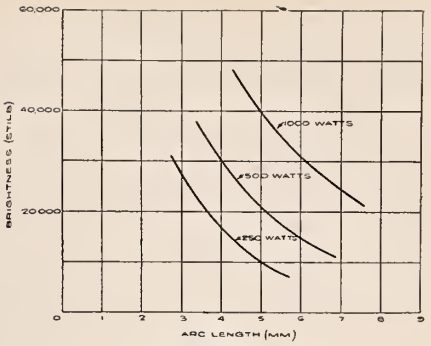


FIGURE 5

Variation of brightness with arc length and wattage. (Arc voltage 60-75 volts)

The percentage of red radiation in the discharge increases as the energy dissipated by the discharge increases. The proportion of red increases from about 1 per cent in the case of the ordinary 400-watt general lighting lamps to 4 or 5 per cent in the compact source lamps of the type described herein.

There are numerous methods by which to improve the color of the high pressure mercury vapour discharge. Unfortunately, one of the most efficient of these, namely the use of fluorescent powders, cannot be easily adapted for projection purposes. This is because fluorescent materials operate efficiently only when their temperature is low. It is not easy to arrange for fluorescent material to receive and radiate sufficient light in such a way that it will improve materially the color of a high brightness source, without involving at the same time operation at a high temperature.

All other methods of improving the color have in common the fact that they involve some sacrifice in efficiency. Thus, it is well known that the addition of certain elements such as cadmium to the discharge will increase the amount of red radiated, but it necessarily reduces the total amount of light, and the greater the amount of red radiation added in this way, the greater the sacrifice in efficiency.

There are other possible methods of modifying the color of the discharge in the compact source lamp, *e.g.*, by the presence of an incandescent body in the arc stream. Alternatively, the color can be modified in the projected beam by the superimposition of an image of the arc on to a tungsten filament. These possibilities still are in the experimental stage.

● Operating Data

The compact source lamp is suitable for operation on d.c. as well as on a.c. circuits. In general it is possible to design a lamp of the compact source

type so that it will operate satisfactorily on both a.c. and d.c. In order to obtain the best performance, however, it is sometimes necessary to make modifications in the electrode system for operation on d.c. and to have auxiliary apparatus to assist starting.

One important consideration which figures into account in the design and application of lamps of the compact source type is the possibility of a lamp bursting. The 500-watt lamp described above operates with an internal mercury vapour pressure of some 15 atmospheres. If a lamp such as this bursts either through misuse or any other cause, the pieces of the quartz inner may be driven with sufficient velocity to fracture the outer bulb and may even pierce the outer bulb with sufficient residual momentum to cause injury to anyone near.

The possibility of such a burst becomes greater the larger the wattage of the lamp and the higher the brightness. In all cases, however, it is to be expected that the manufacturer will render this possibility remote. Moreover, lamps for projection purposes are practically always used in a housing for the purpose of avoiding stray light, which serves also as a protection.

One type of lamp which is being developed experimentally has a metal casing round the quartz bulb instead of the usual glass outer jacket. A glass window in the side of the metal case allows a beam of light to be emitted. In certain cases. the window may itself be a lens which is part of the optical system.

Reduced Heating in Beam from Mercury Lamps.—There is an important advantage of the mercury lamp in quite another direction. A high-power tungsten spotlight will produce a considerable temperature rise of objects in the beam. When falling on the human face, 2,000 ft.-c. of tungsten light will produce marked discomfort after a few minutes. With a similar spotlight using a compact source lamp it was found possible to remain under as much as 6,000 ft.-c. almost indefinitely without discomfort. The actual temperature rise of the skin surface covered with theatrical make-up with the mercury lamp is about one-quarter of that with the tungsten lamp.

The lower heating in the beam from the mercury lamp is explained by the higher luminous efficiency of the source, and also by the fact that the heat radiation from the lamp comes mainly from the quartz bulb and outer envelope, which radiate at a low temperature as compared with a tungsten filament. Such radiation is of longer wave-length than that from the filament and is, therefore, more absorbed by the glass lens of the spotlight.

Lenses and mirrors are frequently used to produce and direct a converging beam of light on to an object so as to illuminate it strongly or to pass a large flux of light through it. Where the object is small, as in the case of a microscope specimen, an image of the source or of a flashed lens is formed upon it. Clearly, the brightness of the image will be proportional to the brightness of the source, so that in this application the full value of a high brightness source will be appreciated. In effect, the film projector uses an illuminating system of this form.

● The Film Projector

The optical system of the film projector does not differ in principle from that of the lantern-slide projector, but on account of the small size of the film to be projected and its proximity to a relatively large objective, the arrangements of the components is rather different.

A typical arrangement is shown in Fig. 6. In order to obtain as high a

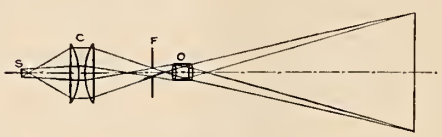


FIGURE 6

Optical system of film projector

screen illumination as possible the objective lens *O* frequently has an aperture greater than the width of the film at *F*. For a given throw and image size, greater magnification is required than with the lantern-slide projector, and the objective lens is, therefore, of shorter focus.

It will be seen that on account of the relative sizes of film and objective lens and the distance between them, the image of the source *S* is formed at or near the film itself rather than on the objective lens.

Various illuminating systems are used. In Fig. 6 condenser illumination is illustrated, but similar results may be achieved by using an ellipsoidal mirror behind the source, or a paraboloidal reflector behind the source and a large-diameter, low-power, single condenser in front of it, to concentrate light on to the film.

● Projection Test Results

With each system, providing the condenser or mirror is of sufficient size, the objective lens appears fully flashed from the screen, and the projector intensity and screen illumination are thus proportional to the source brightness.

Tests with an experimental compact source lamp having an effective brightness of about 26,000 sb.* in a 14-in. diameter mirror illuminating system gave an effective brightness of the flash of the objective lens of 15,000 sb., the absorption of the mirror and lens and the obstruction of the lamp and its support resulting in a transmission of 58 per cent.

Using a 12 cm. focus objective lens, it was found that the diameter of the circular area of lens flashed was 5.7 cm. The measured maximum projector intensity, which is the product of flashed lens area and flash brightness, *i.e.*, 25.5 x 15,000, was 380,000 candles. When the rotating shutter is running, the intensity is approximately halved.

The aforementioned values are those obtained for an axial direction in which the flashed area of the lens is a maximum. In the direction of the edges of the projected image, the intensity is usually lower, as the vignetting action of the front and back lens components reduces the flashed area in these directions. The average intensity has been found to be approximately 80 per cent of the maximum, and with the aforementioned objective, the measured average intensity with the shutter running was 152,000 candles, and the flux on the screen, 3,350 lumens.†

The throw for which such an intensity is suitable depends on the screen illumination required Values measured in picture houses range from 3 to 30 ft.-c., but 10 ft.-c. is considered a good average figure for modern practice. Calculation shows that the throw at which a projector giving 152,000 candles will produce 10 ft.-c. is 123 ft. An illumination of 3 ft.-c. would be produced at a throw of 225 ft.

Using a 12 cm. focus objective, the size of the projected image at these two throws would be 21 ft. 6 in. x 15 ft. 6 in., and 39 ft. 4 in. x 28 ft. 6 in., respectively.

It would, therefore, appear from these results that the compact source lamp is practicable for long-throw projection. As the projector intensity, and thus the screen illumination, are proportional to the source brightness, it was found, as expected, that a compact source lamp operating at 26,000 sb. gave an intensity ten times that of a tungsten lamp having an effective brightness of 2,600 sb.

In comparison with a 55-ampere high-intensity arc, the compact source lamp gave about 30 per cent lower illumination. This would be consistent with the arc having a mean effective brightness of 37,000 sb.

In the smaller projectors for 8, 9.5

*Candles per square centimeter.
† Approx. standard film aperture used.

Now After Exhaustive Comparative Tests

FILM-WELD

Successor to Film Cement

Is adopted as Standard by

WARNER BROTHERS EXCHANGES

Exchange work makes exacting demands upon a film binding agent. The splice must be made secure—and quickly. Now, in Warner exchanges splices are made the modern way—with FILM-WELD, the successor to film cement. Now, America's theatres receive Warner reels with thinner yet more rugged splices.

This progressive move by Warner exchanges was the inevitable result of a series of exacting and exhaustive tests during which all makes of film cement and FILM-WELD were put to the acid test. FILM-WELD's superiority on all counts was overwhelmingly established.

And why not? Warner exchanges now need not empty their cement bottles twice daily, nor be careful not to expose too much cement at one time. Because FILM-WELD does not thicken, spoil or discolor—even when exposed to the air. It retains its full strength down to the last drop, requiring no thinning agent. It firmly binds all film—nitrate, acetate, black-and-white and color. It goes twice as far as ordinary film cement—naturally.

First proven best on the projection firing line in thousands of theatres, FILM-WELD now delivers perfect results in major exchanges. And Warner is but the first such group to adopt FILM-WELD—more are on the way. Get your FILM-WELD from any one of the 108 dealers throughout America who now stock this modern splicing agent.

Instructions for use

FILM-WELD should never be put into a container that has been used for film cement, or a brush used that has been used with film cement. Use FILM-WELD sparingly; just enough to moisten the film is sufficient, as any excess slows up the drying process.

On prints that have been treated with emulsion hardener, it is necessary not only to remove the emulsion, but the film itself must be scraped, so as to remove the hardener. The non-emulsion side should also be scraped.

Color film should be scraped on both sides.

FILM-WELD not being a cement but a bonding agent, it is absolutely necessary to remove any foreign matter so that the two films themselves are brought into contact.

If these directions are followed, a permanent bond will result.

LARRY STRONG, INC.

1241 So. Wabash Ave., Chicago, Ill.

and 16 mm. films, the optical system often approaches more nearly that of the lantern slide projector, for with a tungsten lamp a light source as large as the film is easy to obtain. In this case the condenser C is moved close to the film and the source is often moved as close to the condenser as the bulb will permit. The condenser can then be of much smaller diameter. A similar optical system is used for a 35 mm. projector using water-cooled mercury lamps.

Tests have shown that using a 500-watt compact source lamp in place of a tungsten lamp of similar wattage in a 16 mm. film projector, the resulting screen illumination is increased in proportion to the light output of the lamp. *i.e.*, about 2½ times, as was the case with the lantern slide projector. Where the optical system is designed so that the bulb of the tungsten lamp is located close to the condenser lens, a longer focus condenser may be required for compact source lamps having larger bulb diameters.

When colored films or slides are projected with a compact source lamp, as would be expected from previous considerations, red and near-red colors are dulled. It is not possible to describe the extent of the effect in precise terms, but with films processed for daylight or for projection with an arc source, *e.g.*, Dufaycolor and Technicolor, the view has been expressed by representatives of the cinema industry that for informal presentations where black-and-white films are usually projected and color films, only occasionally, the color distortion is not sufficient to matter.

● Color Film Tests

Possible ways of correcting the color have already been dealt with. A series of comparisons was made on Technicolor films by viewing adjacent frames, one illuminated by the light from a high-intensity arc, which may be taken as an approximate standard of daylight, and the other by the light under test. It was found that the addition of a yellowish-red color filter improved the color rendering with the compact source lamp, but more satisfactory results were obtained when the red ratio of the light from the lamp was increased.

● Disadvantage of Filters

By the use of a filter combined with the methods mentioned earlier of increasing the red ratio, very satisfactory color rendering was obtained. The disadvantage of the color filter is the inevitable loss of light by absorption. It should be remarked, however, that when making comparisons with tungsten lamp projectors, a similar absorption must be allowed for, as a blue filter is required to obtain correct color rendering when projecting Technicolor or Dufaycolor films with tungsten lamps.

Kodachrome and Agfacolor films are processed for projection with the light from tungsten lamps. Neither the arc, unless a filter is used, nor the compact source lamp will, therefore, give satisfactory results with this class of film.

New Brenkert 'Senarc' Intermediate H-I Arc Lamp

By *KARL BRENKERT*

PRESIDENT, BRENKERT LIGHT PROJECTION COMPANY

THE definite purpose in presenting the new Brenkert Senarc projection lamp is to enable the smaller theatre to solve the problem of snow-white light projection to properly project colored pictures in their true color tones and sufficient light intensity to bring out every detail of the picture at a first cost and operating cost commensurate with the size and income of such theatres. This new light source brings a new high standard of projection to the smaller theatre fully comparable with that obtained by the large and medium-sized theatres.

● Screen Light Level

In determining what would constitute this so-called smaller theatre, a measurement of seating capacities up to 800 seats, screen sizes up to 18 feet in width and projection distances up to 100 feet has been chosen.

It is generally conceded that for the proper presentation of colored pictures, which are increasing in number, a screen intensity of approximately 10 foot candles with the projector running is required, and the characteristics of the light should be white like that of sunlight, which is the natural white light spectrum.

Many theatres have seating capacities, screen sizes and projection distances less than the maximum, therefore it is desirable that this new light source be adjustable as to total light output, expressed in lumens, so that the chosen standard of 10 foot-candles can be closely maintained in these various size theatres.

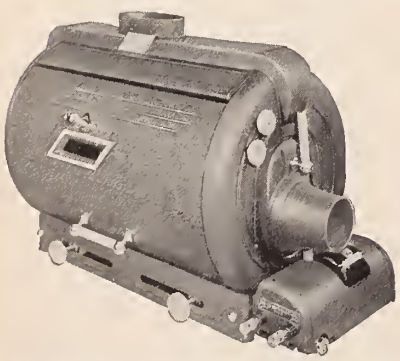
This is accomplished on the new Brenkert Senarc lamp by a new type of arc control which permits operating two various size carbon trims between 30 and 40 arc amperes. These carbon trims are now available, one being the 6 mm. positive and 5 mm. negative operating at 30 to 35 amperes; the other being the 7 mm. positive and 6 mm. negative operating at 40 amperes.

The electrical energy consumed at the arc is a minimum of 750 watts at 30 amperes, up to a maximum of 1150 watts at 40 amperes. The light on the screen without the shutter running is 3300 lumens at 30 amperes, up to a maximum of 4300 lumens at 40 amperes. The arc screen intensity on a 14 foot wide screen at 30 arc amperes is approximately 10 foot-candles; and with an 18-foot screen at 40 amperes is also approximately 10 foot-candles.

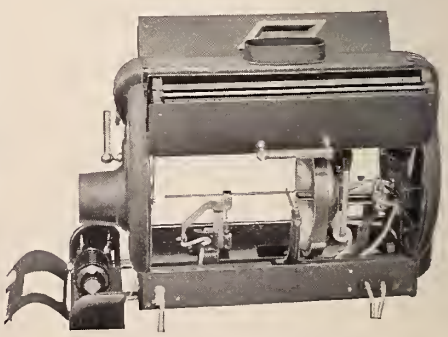
These screen intensities are based on the single-shutter type projector with the projector running. Where the more efficient double-shutter type projectors are used, the screen intensities will be higher than these figures; therefore, current at the arc can be reduced, with resulting lower operating cost, to maintain the desired 10 foot-candles.

It will be readily noted from the foregoing figures that this new light source operates at the lowest wattage of any arc type of light source that has yet been used for motion picture theatre projection.

New power sources have been devel-



Side view of Senarc, showing controls



Interior view of Senarc lamp

oped and are now ready for the market for use with this new light source. These power sources are available in tungar-type rectifiers or motor generators. The motor generators are available in either the constant-voltage type, which use ballast resistors, or the double-generator series type wherein no ballast resistors are required. The efficiency of these new power sources range from 60 to 70 per cent, which develop an overall power consumption as drawn off the line from 1300 watts at 30 arc amperes to 1960 watts at 40 arc amperes.

The Brenkert Senarc lamp naturally operates on direct current only. The power sources are for operation on two- or three-phase line. This combination means there will not be any flicker caused by the light source at any time, either with single-shutter or double-shutter type projectors.

No doubt this question will be asked: How does the result from this new light source compare with that obtained from a low-intensity lamp, or from the present 45- to 65-ampere high-intensity lamp? The screen intensity as measured by a foot-candle meter will show the light from the Senarc lamp to be appreciably greater than with the low-intensity type of arc. In addition, the light produced from the Senarc lamp is white as compared with the yellow light produced by the low-intensity type lamp.



Overall exterior view of Senarc

Operating Costs

The costs of operation for carbons and current in the Senarc lamp will vary from 11 to 16 cents per hour, depending upon the amount of current used at the arc and the cost per kilowatt hour of the current. The cost of the low-intensity type of arc is not ever less than this figure, and in most cases higher.

The 45- to 65-ampere high-intensity type of arc, used in most theatres above 800 seats, has a total light output of from 5000 to 6200 lumens at an operating cost of 22 to 32 cents per hour for carbons and current. The quality of light from the new Senarc is the same as that produced by the present 45- to 65-ampere high-intensity arcs.

This new Senarc lamp enables the smaller theatres to have the same high standard of projection as the larger theatres at proportionately lower cost of operation, an opportunity heretofore not available.

Current Television Developments

ELATION within the ranks of television sponsors when the F.C.C. announced the granting of limited commercial licenses on Sept. 1 next was short-lived and quickly turned to gloom when the Commission, in an unexpected about-face reversed itself and announced that further hearings would be held to determine whether "research, experimentation and achievement of high transmission standards are being unduly retarded by RCA's promotional and marketing activities."

This decision by the F.C.C. is now under scrutiny by Congressional committees, several members of which are demanding an end of Commission control over this baby art.

Lower Receiver Prices

However short-lived was the elation of the television camp, it sufficed to uncover the plans of the television interests, particularly RCA, to promote the art, the details of which are extremely interesting to motion picture people. RCA's first move was three-fold: (1) announcement of a 33-1/3% reduction in the price of receivers; (2) scheduling of double the present number of telecasts by N.B.C., and (3) an extensive promotion campaign to sell 500 sets a week. Price cut includes refund of the difference between original and reduced prices to early set buyers.

New price reduces the former $600 sets to $395; the former $450 models to $295, while the two lower price sets will sell at $169.50 and $99.95. The latter two models will only be sold at this price, however, as long as the present stock lasts. RCA must sell 35,000 sets this year to break even. NBC is down for a $700,000 program expenditure this year as part of the buildup.

It was disclosed that approximately 2,500 sets are in use within range of N. Y. television stations, with a survey revealing that: four or five people watch programs on each set; larger groups gather to watch programs in eating places; majority of fans devote from one to five hours a week watching programs; 21 per cent watch all of the 12½-hour weekly schedule; and an audience of 10,000 to 15,000 per week now view the tele shows.

Two days later RCA filed application with the F.C.C. for television stations in Philadelphia, Washington, and Chicago, and disclosed that its first relay system network would link N. Y. City and Philadelphia. Following a pronouncement by David Sarnoff, president of RCA, stressing RCA's ability to "proceed to establish television on a broad public service basis."

Nationwide Coverage

Sarnoff declared that as soon as the New York-Philadelphia relay service is in operation, permission will be sought to extend the service to Washington, and subsequently to Boston and other cities "so that eventually television program services may be extended to cover the nation."

Three of the four cities named by Sarnoff now have tele stations. Philco holds licenses for W3XE and W3XP in Philadelphia, the General Television Corp for W1XG in Boston, and Zenith for W9X2V in Chicago. WCAU Broadcasting Co. of Philadelphia, Boston Edison Co. and Balaban & Katz, Chicago, have tele station applications pending before the F.C.C. at the present time.

The RCA president also revealed that NBC will be prepared to provide television program service as soon as radio relay systems are established. The tele program service will be furnished to independent stations "that are interconnected, similar to the manner in which RCA now furnishes a sound program network service. The television network radio relays to be constructed by RCA will provide a service available for use by other broadcasting companies in the same way that trans-oceanic facilities of RCA are now made avail-

HEYER-SHULTZ BULLETIN ON ALL-METAL REFLECTORS

Heyer-Shultz Co. is now distributing a most interesting bulletin entitled "Getting the Most Out of Your All-Metal Reflectors". This bulletin is crammed with technical data which is indispensable for all projectionists working with metal reflectors, no less than for those who wish to keep abreast of developments in the art.

These bulletins are available at all branches of the National Theatre Supply Co., or they may be had direct from Heyer-Shultz, 39 Orange Road, Montclair, New Jersey.

able to competing broadcasting systems," he declared.

Sarnoff pointed out that RCA has licensed competitors to use its inventions in the tele field, and that RCA and other manufacturers are ready to supply transmitters to broadcasters who may wish to embark upon television.

● Tele-Film Situation

Meanwhile, relations between television broadcasters and the motion picture industry remained strained due to the refusal of film producers to supply product for telecasts. Unofficial sources report that RCA has a year's supply of film on hand at present; but RCA continues to woo the film industry for immediate product. Although denying that it will make its own films, the while it insists that the film industry will "cooperate eventually," RCA is understood to be readying plans for film production. This will leave the present film producers holding the well-mentioned bag.

Whatever the outcome of the present muddled television situation, it is held likely that because of severe Congressional and other pressure the F.C.C. will relent in its present stand and O. K. limited commercial television licenses effective at an early date.

THEATRE MEN WORRIED ANENT F. C. C. TELEVISION REPORT

While broadcasters issued cheery statements designed to allay fears that television would injure the motion picture business, exhibitors openly expressed concern over the F.C.C. "green light" report, which they regarded as very unwelcome news. Consensus of opinion is that distributors may be able to control the situation at the start by refusing to supply film product, but that they will eventually succumb to the lure of tele dollars and enter production therefor.

RADIO'S 'TAKE' FROM MOVIES

Estimating that 20,000,000 people listen to four major broadcasts each evening, with the proportion of entertainers to the entertained at about 1,538,460 to 1, A. B. Meany of Floral Park, L. I., in a newly published book, "Radio and Its Offspring: The Present Depression," contends that but for radio the following would be required to provide the same amount of entertainment for the same national audience:

13,333 theatres (average capacity of 1,500); and same number of cashiers, ticket takers, managers, stagehands, porters; 39,999 ushers (three to a house, as an average); 133,333 musicians (10 to the band) and as many instruments, and 20,000,000 tickets and programs. Meany claims radio has robbed 239,994 persons of jobs in the set-up for an evening's entertainment, as he figures it.

MIXED EARNINGS FOR FILMS SEEN BY POOR'S SURVEY

Motion picture industry faces mixed earnings prospects, according to Poor's Industry and Investment Surveys. The European war will cause a sharp decline in foreign revenue. Meanwhile, only a small amount of new business will be derived in South America, since 95% of this market is controlled by U. S. interests.

Domestically, a high level of consumer income is expected to raise theatre attendance moderately above current volume. With some curtailment of production and studio retrenchment outlined, profits from the domestic market promise to be satisfactory.

On three premises—a prolonged war abroad, maintenance of U. S. neutrality, and development of a good volume of export business—a marked rise in domestic industrial activity is forecast. Higher consumer incomes, which will accompany this development, will be reflected in greater theatre attendance.

EASTMAN'S BIG 1939 NET

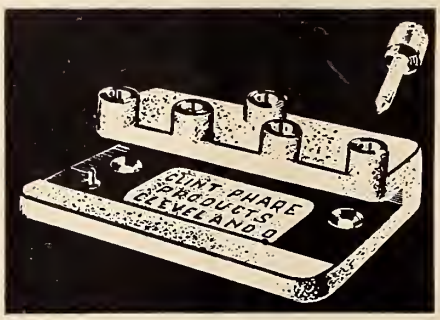
Consolidated net of Eastman Kodak Co. and wholly-owned subsidiaries for 1939 was $21,537,577, equal to $8.55 per common share, after deducting dividends paid on preferred. This compares with 1938 figure of $17,339,408, or $7.54 per share. Total consolidated sales amounted to $140,331,990, an increase of 9.4 per cent over 1938, when sales were $128,262,832.

The report discloses that the amateur photographic field led total sales with 33 per cent; professional and commercial bracket, 21 per cent; film, negative and positive for the motion picture industry, 16 per cent; cellulose acetate products, 14 per cent; photographic accessories, 6 per cent; chemicals, 6 per cent; and miscellaneous, 4 per cent.

SIGNO-MARKER A FINE AID IN REDUCING FILM MUTILATION

Elimination of unsightly scratches, punch holes, pencil blotches, etc., on film prints is accomplished by a device just introduced by Clint Phare, one of the old-timers of Cleveland Local 160. Eminently successful in preliminary tests, this new device, the Signo-Marker is now offered to the craft at the ridiculously low price of $1.98.

The introduction of the Standard Release Print, hailed by the industry as an effective bar to print mutilation, has fallen far short of this goal. Mutilated film is as evident today as it was ten years ago. Signo-Marker places a clear, small circle of from one to four frames in standard dot position, and also outlines hard-to-see standard marks or places new marks where the originals have been obliterated.



The Phare Signo-Marker

The device consists of a cast aluminum template and a hardened steel scriber which may be held in the hand or screwed to the rewind table. Any frame line is placed even with the left-hand edge of the template, then the nearest sprocket hole is dropped over the steadying pin which is provided to prevent slipping. The scriber is inserted into one to four holes and, with a light pressure, is turned clockwise one or two revolutions to the right. Hole is provided to hold the scriber when not in use. Signo-Marker is endorsed by I. P.

An illustrated circular is available upon request to Clint Phare, 282 East 214th St., Cleveland, Ohio.

G. T. E.'s $696,062 NET

General Theatres Equipment Corp. reports consolidated net profit for 1939 of $696,062 equivalent to approximately $1.17 per share on 592,887 shares of capital stock outstanding, and compares with 1938 net profit of $507,267, equivalent to 85 cents per share on 597,887 shares.

The net includes dividends of $185,600 received on the common stock of 20th Century-Fox, which was one-half the amount received in this investment in 1938. Currently no dividend is being paid on 20th-Fox common.

During the year the corporation retired 5,000 shares of capital stock in the open market at a cost of approximately $9 per share, charging the cost to paid-in surplus.

BOSTON L. U. 182 GALA PARTY ON 30TH ANNIVERSARY

Boston Projectionist Local 182 will observe its 30th anniversary on May 1 with an all-day celebration at the Copley-Plaza Hotel in that city, culminating in a monster banquet in the evening for which almost 800 reservations, including those of many film notables, have already been made.

A feature of the festivities will be an exhibit of motion picture equipment dating from the early days of the industry down to the present, including one projector head which many old-time projection men have failed to identify. The exhibit is so designed as to impress both those within and without the industry with the importance of projection and the competency of L. 182 members.

N. Y. LOCAL 306 WINS WAGE INCREASE OVER 5 YEARS

Terminating an extended tussle with the *major theatre circuits* of New York City, Local 306 projectionists union won an immediate 8% wage increase, retroactive to Sept. 1, 1939. A further increase of five per cent goes into effect on Sept. 1, 1941, and a further increase of two per cent becomes effective Sept. 1, 1943. Entire contract ends Aug. 31, 1945.

Settlement was arrived at without a decision by the impartial arbitrator, Prof. M. J. Handler, of Columbia University, being necessary. An additional week's vacation with pay is also included in the new contract, giving each projectionist two weeks with pay.

Increase compensates in part for a 11% wage cut of five years ago.

LEMKE, EX-I.A. HEAD, DIES

James Lemke, 67, former president of the I.A.T.S.E, died recently in Troy, N. Y., where he had been active in labor circles for more than 30 years. A familiar figure at International and district meetings, Lemke was extremely popular with all members of the craft.

NICK RESIGNS I.A. POST

General Office of the I.A.T.S.E. has announced the resignation of John P. Nick as first vice-president due to ill health. Head of Local 6 (stagehands) of St. Louis, Nick has long been prominent in the I.A. official family.

EXCHANGE FIRE LOSS NIL

Fire damage in American film exchanges during the last year did not exceed $100. There were only two unimportant exchange blazes, and in both instances loss was not more than $50.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

VENTILATING problems are imminent; and, since experience is reputed to be a great teacher, the following is offered for the weal of projectionists and managers who have to worry about such things:

One night last June I went into a theatre and found the place stifling, although it was equipped with a modern pressure ventilator. The manager said he had been complaining to his home office for seven weeks and that they decided an expert ventilation engineer was needed—"as soon as one was available." He had eight walkouts that evening, so I decided to look over the system myself.

The system consisted of two drum-type fans in tandem arranged to draw cool air from outside in summer and with ducts and dampers to permit heating and recirculation in winter. While heat had been necessary the results had been fine; and the manager said that in 1937 when the theatre was built the cooling had been perfect. There were four speeds on the fans, but at the time the top speed produced only a faint movement of air.

After the show I had the local electrician check the wiring, which was found to be OK, while I checked all ducts and dampers. Finally I crawled into the fan room and decided that the fans were turning in the wrong direction. Reversing one leg of the 220-volt, 3-phase supply gave proper rotation, and the system then functioned perfectly. The exhibitor was saved the expense of having an expert in on the job.

We found afterward that a representative of the local electric company had been making demand load tests at the theatre in April, and we assumed that he had changed the leads while connecting his instruments. This drum-type fan is peculiar in that when it is reversed it continues to blow air but at a very low rate.—F. A. BROWN, *Altec, Boston.*

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Projectionists who are following the progress of television will be interested in R.C.A.'s new Iconoscope tube which will be known as the "Orthicon." This new eye for the television camera can see through a wide variety of lenses and under a wide range of lighting conditions. The "Orthicon" will enable the telecasters to pick up programs on a cloudy day or when the setting sun dims the scene. The problem of lighting the scene to be televised has been of major importance in the past.

• • •

It is frequently convenient to use a cork stopper in the film cement bottle. However, the mouth of the bottle and the cork stopper soon become coated with the dried cement, resulting in an unsatisfactory arrangement. If the cork is first coated with a thin layer of oil, it can be used for months without difficulty. Be careful not to get any oil in the cement. — W. W. GILREATH, R.C.A., *Louisiana.*

[NOTE: *Good stunt, but wholly unnecessary since introduction of new splicing liquid that neither discolors, hardens or thickens, requires no thinning agent, and retains its "oomph" down to the last drop.*—ED.]

• • •

Request for service stated: "Running on zero (volume control point) on one machine—still too loud. Other machine OK." It developed that this unusual condition was due to one of the output wires being grounded to its lead shield, thus short-circuiting the volume control which fed the full output of the machine into the main amplifier.—PETE CASE, *Altec, Newark, N. J.*

• • •

Every projection room equipped with Simplex projectors should carry an extra G112 gear. This gear would be the first to strip in the event of a bind-up in the mechanism. The G112 gear is a mechanical fuse in a gear circuit, so to speak, and a spare should be on hand at all times.—C. B. ZIMMER, R.C.A., *New Jersey.*

• • •

Who hasn't had trouble with noisy rheostats, particularly on the old-style systems using direct current for vacuum tube filament supply?

I have had more success in eliminating rheostat noise by connecting an electrolytic condenser directly across the terminals of the filament rheostat itself, than by connecting the condenser directly across the power supply, as is the usual practice.—R. P. EGRY, *Altec, Pittsburgh.*

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More cold weather news relative to the tolls exacted by old man winter. This is a case of a "delayed" trouble.

At the Colonial Theatre, Moravia, N. Y., the sound system was badly damaged and inoperative due to events as follows: Cold weather froze and broke the pipes of the sprinkler system in an upper floor of the building. Nothing happened until the pipes thawed out and began to leak, when water ran down onto the sound equipment.—G. A. BROWN, *Altec, Syracuse, N. Y.*

• • •

Extreme care should be exercised when installing any a.c. type arc lamp, in order to prevent hum pickup in the sound system. The proper ground should be installed and particular attention given to loose connections in order to prevent circulating currents. Wires carrying a.c. or pulsating d.c. should be twisted whenever possible. The field set-up by parallel a.c. leads are the source of many hum troubles. —S. H. SCHULTZ, R.C.A., *Washington, D. C.*

• • •

Oil collects dirt, deteriorates insulation on wires, impairs the efficiency of a lens system, and is one of the most frequent causes of inferior sound. M. A. Walsh, R.C.A. Field Engineer in the New York district says that the best way of preventing excess oiling is to use an oil can with a small spout from which you can place oil in a bearing at will and in definite quantities of one or two drops at a time. Excess oil should be wiped off frequently and absorbent pads used at the base of the projector head.—M. A. WALSH, R.C.A., *New York City.*

• • •

The best place to store a spare fuse is right beside the fuse receptacle, or tied to the receptacle.

When a motor refuses to start, try spinning it by hand while the current is on—the centrifugal switch may be stuck.

Any apparently minor sound troubles should be noted on a slip of paper and reported to the sound engineer on his next call. Troubles which have apparently corrected themselves will be of particular interest, since these troubles may indicate the development of a major defect. Be sure to write it down, as these minor troubles experienced are often forgotten.

Every projection room should be equipped with a first-aid kit and chart.—M. B. FAIGE, R.C.A., *Boston.*

New 11-MM. Non-Rotating H.I. Carbon Doubles 'Suprex' Type Light†

By *D. B. JOY, W. W. LOZIER,* and *R. W. SIMON*
MEMBERS, ENGINEERING DEPARTMENT, NATIONAL CARBON COMPANY

The high-intensity, direct-current arc between small, copper-coated carbons operated in coaxial alignment without rotation with a reflector optical system has achieved a widespread and growing popularity over the past few years for theatrical projection of motion pictures. This type of light-source has now been extended to include larger carbons and higher currents. These larger carbons of this type with the proper optical system will give substantially higher light on the motion picture screen.

Fundamental facts about the arc behavior and the conditions necessary to obtain stable and steady operation with these larger carbons are described. The correlation of the luminous characteristics of the arc with the optical system is reviewed. The performance of a new arc with a suitable optical system is given from the standpoint of offering possibilities for projection. Carbon consumption rates, arc current and voltage, and light on the screen are discussed.

FROM the beginning, light for projection in motion picture theatres has been furnished almost exclusively by the carbon arc because of its high intrinsic brilliancy. However, the early carbons, and optical systems used to utilize their light, were a far cry from the carbons, lamps, and optical systems of today.

Some of the more important changes are the application of the high-intensity arc to motion picture projection, making possible the large theatres of today; the use of a mirror and small carbons instead of a condenser and large carbons for low-intensity arc projection; improvements in condenser lenses for high-intensity carbons; the advent of the so-called "Hi-Lo" high-intensity reflecting arc lamp; and more recently, the extension of the high-intensity arc on an economical basis to the medium and small theatres by the simultaneous improvement in mirror optical systems, and simplification of high-intensity lamp design made possible by the development of the small size, non-rotating copper-coated "Suprex" carbon.

These simpler types of high-intensity reflecting arc lamps and "Suprex" carbons have become standard equipment in a majority of the medium size theatres. The characteristics of this system have been described before, two of its outstanding features being high efficiency and simplicity. The ever-present demands for increased screen illumination have led to research to extend these high-intensity arcs with non-rotated carbons to larger sizes using the reflector system.

This paper presents for consideration and describes the characteristics of larger-size, non-rotating, high-intensity, d.c. carbons and discusses means of utilizing them in a manner which will make it possible to double the screen light obtainable with systems in common use today, and to do this in some cases with less energy input into the arc. These results represent several years of research and development work on the theoretical and practical aspects of the problem.

† J. Soc. Mot. Pict. Eng., XXXIV (March 1940).

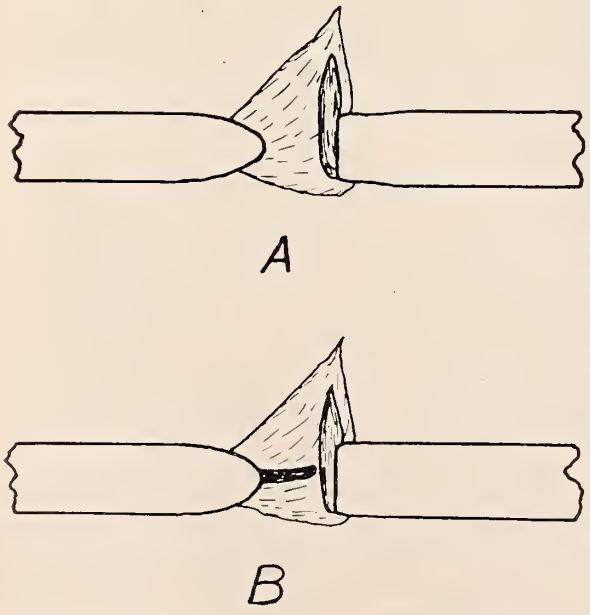


FIGURE 1

Sketches showing the appearance of the direct-current arc with coaxially-aligned electrodes: (A) with no negative "tongue"; (B) with negative "tongue."

Higher Current Effect

The accepted practice of not rotating the positive carbon, and the approximately coaxial alignment of the positive and negative carbons, have resulted in desirable mechanical simplification of the lamp mechanism and the problem of arc control. This arrangement has given stable burning with 6-mm., 7-mm., and 8-mm. "Suprex" positive carbons, the latter of which is used with currents up to 65 amperes.

Attempts to use a 9-mm. positive carbon in the lamps designed for "Suprex" carbons met with serious difficulties when the arc current reached approximately 75 amperes. At about this current a transition was observed in the nature of the arc stream. This transition was characterized by the occurrence of a relatively dark "tongue" in the arc stream which appeared to originate at the tip of the negative carbon and extend some distance into the arc stream. The appearance of the arc stream at currents below and above this transition point is shown in Fig. 1(*A*) and (*B*), respectively.

With the coaxial alignment of electrodes, this tongue from the negative carbon is directed into the positive crater and causes the arc to become

Current	Approximate Arc Voltage	Consumption (Inches per Hour) Positive	Consumption (Inches per Hour) Negative	Intrinsic Brilliancy at Center of Crater Candles per Sq Mm	Total Crater Candle-Power
110	56	13	2.3	640	30,000
115	60	16	2.4	700	35,000

TABLE A

Burning characteristics of 11-mm special non-rotated positive carbons and 3/8 inch negative carbons burned at 35° angle

unstable, and the light is erratic and unsteady. At currents considerably higher than 75 amperes, this tongue goes over to the familiar bright inner "core" or tongue appearing to be attached to the negative carbon of standard well known arcs such as the 125-ampere arc between the 13.6-mm. high-intensity positive carbon and 7/16-inch "Orotip" negative carbon. In this latter case the negative carbon is used at an angle with the positive, and the bright tongue in the arc streams up in front of the positive crater instead of directly into it, and so causes no instability.

Different factors were observed to have some small effect on the current at which this instability occurs, but in no case was a factor of safety obtained which was sufficient to insure reliable operation with the large non-rotated carbons in coaxial alignment. However, it was observed that very satisfactory operation could be obtained without rotation of the positive carbon when the negative carbon was placed at an angle with the positive carbon, the range of 30 to 40 degrees appearing to give best results. Other angles of burning than the range suggested may be made desirable by the use of auxiliary magnetic flux or by other design features of the lamp.

With this arrangement, it is possible to burn large-diameter non-rotated high-intensity positive carbons at high currents. In fact, it has been possible to burn positive carbons 15 mm. in diameter above 150 amperes, with indications that still larger carbons and higher currents can be used under these same conditions. Operation is steady and easily controlled without the use of auxiliary magnetic flux.

● The D-C Arc With Angular-Trim and Non-Rotating Carbons

With this knowledge of the proper method of burning these larger carbons without rotation of the positive carbon, we proceeded to develop copper-coated positive carbons in sizes appreciably larger than the present 6- to 8-mm. "Suprex" carbon range and having desirable characteristics for angular-trim reflecting arc lamps. We have also included in our development for angular-trim burning, carbons of the smaller diameters and have data on positive carbons (with suitable negatives) for this purpose ranging from 5-mm. to 15-mm. in diameter in 1-mm. steps.

Burning characteristics of an 11-mm. copper-coated non-rotating positive carbon with a suitable negative carbon are given in Table A. This non-rotating angular trim gives steady light and has stable operating characteristics at the current and voltage indicated. It has been designed to give a higher intrinsic brilliancy than the 8-mm. "Suprex" at its maximum current of 65 amperes.

A comparison of the intrinsic brilliancy distribution across the crater face of these two carbons is given in Fig. 2. This figure shows also the relative size of the light-source from the 11-mm. carbon compared with the 8-mm. "Suprex" carbon. The question of how most efficiently to take advantage of this increased brilliancy and larger source diameter in motion picture projection brings up the consideration of the properties of the optical system.

● Possible Application

The experience gained with the reflector-type lamps used with "Suprex" carbons provide much useful data on which to base our present considerations. Wide-angle elliptical reflectors having a collecting angle of approximately 145 degrees are employed with "Suprex" carbons, and the magnification ratio of these mirrors is about 6.5 to 7.0.

The portion of the crater brilliancy curve of the 8-mm. "Suprex," which, when magnified 6.6 times, falls within the diagonal of the sound projection film aperture, is shown in Fig. 2. Therefore, this shows approximately the portion of the "Suprex" crater light which is used in motion picture projection today. It is evident that the larger crater of the 11-mm. special carbon will permit a smaller magnification than 6.6:1 and still obtain good coverage on the aperture.

For example, the portion of the curve utilized with a magnification ratio of 5.2:1 is shown in Fig. 2. The 145-degree 6.6:1 elliptical reflector requires an $f/2.3$ projection lens to pass all the light which passes through the center of the film aperture. If the magnification of the mirror were reduced to 5.2:1 while still maintaining a large collecting angle, the relative aperture or "speed" of the system would be increased and a projection lens of higher "speed" could be filled.

The various factors affecting the screen illumination, including source brightness and speed of the optical system, have been discussed previously. Applying these well-known principles to the data in Fig. 2, it is evident that while the 11-mm. carbon would give significant increase in screen light with an $f/2.3$ optical system, this increase will be more outstanding if used with a faster optical system.

● Experimental Arc Results

In order to determine experimentally the possibilities of the 11-mm. non-rotated copper-coated carbons, an experimental burner was assembled. An experimental mirror of proper magnification and angular pick-up was obtained from Bausch & Lomb. The carbons were not rotated, and the negative carbon was placed at an angle of 35 degrees from the positive carbon. The optical system of this lamp is shown in Fig. 3, where the various dimensions of the reflector system are given.

A standard sound-film projection aperture was used in the system without a film shutter. Screen light measurements were taken with a 4-inch focal length $f/2.0$ experimental "Cinephor"

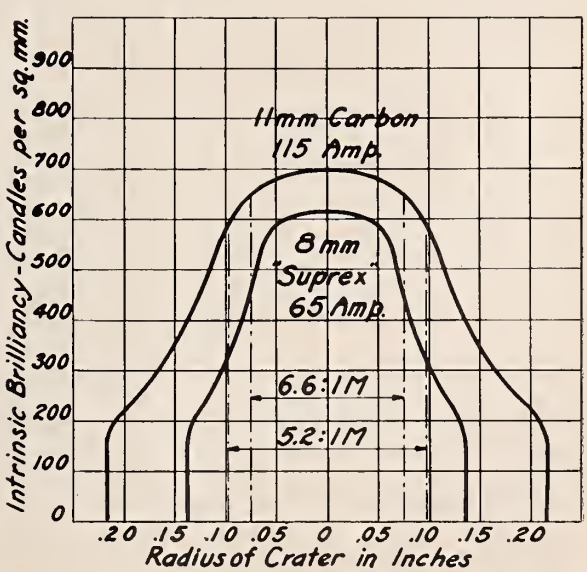


FIGURE 2

Comparison of the intrinsic brilliancy and size of the crater of the 8-mm "Suprex" positive at 65 amperes in a horizontal trim, and the 11-mm carbon at 115 amperes in an angular trim

type projection lens. Weston photronic cells equipped with "Viscor" filters were placed at the center, sides, and corners of the screen image to measure screen illumination and screen distribution.

The results of these screen light measurements are shown in Table B for the same carbons whose burning characteristics are given in Table A.

In order to understand better the significance of the valucs given in Table B they should be compared with the amount of screen light obtained with conventional lamp systems and carbons in use today for motion picture projection. Such figures can be only approximate because of the many factors which affect the total luminous flux falling on the screen.

● Comparative Arc Data

Table C shows the approximate amounts of screen light obtained with various well known carbons and optical systems, and that the new 11-mm. carbon and *f*/2.0 reflecter system described in this paper will give as much as twice the light of the two high-intensity systems most widely used today—the 8-mm. "Suprex" positive carbon with mirror-type lamps, and the 13.6-mm. H.I. positive carbon at 125 amperes with condenser-type lamps.

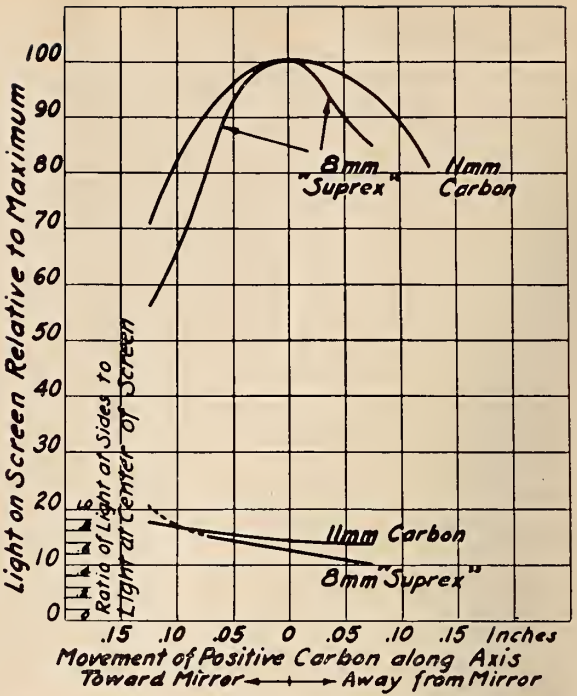


FIGURE 4

Curves showing the change in total screen light and the distribution of screen light with movement of positive carbon, for the 8-mm "Suprex" and the 11-mm carbon used with their respective optical systems

screen light and screen distribution change as the positive carbon is moved along its axis away from the focal point of the mirror. This comparison is shown in Fig. 4, and gives an indication of the "flexibility" of the two arcs with their respective optical systems.

TABLE B

Screen light measurements on the 11-mm special non-rotated copper-coated carbons burned in angular trim

Current	Approximate Arc Voltage	Screen Lumens; No Film Shutter	Screen Distribution Sides to Center
110	56	14,000	70%
115	60	16,000	70%

TABLE C

Screen light obtainable with various carbons and optical systems

Carbons	Amperes	Lamp Optical System	Projection Lens	Screen Lumens; No Film Shutter
8–7-mm "Suprex"	65	Elliptical mirror	*f*/2.3–*f*/2.5	6000–8500
13.6-mm H.I. Pos. 7/16" "Orotip" Neg.	125	Condenser type	*f*/2.3–*f*/2.5	6000–9000
13.6-mm Super H.I. Pos 1/2" "Orotip" Neg.	180	Condenser type	*f*/2.3–*f*/2.5	8000–10,000
11-mm Special Non-rotated C.C. Pos. 3/8" Neg.	115	*f*/2.0 Mirror described in this paper	*f*/2.0 lens described in this paper	16,000

It is of interest to compare the 11-mm. non-rotated positive carbon and the 8-mm. "Suprex" carbon each with its appropriate optical system, as regards the rapidity with which the

It can be seen that the 11-mm. trim has a better distribution of light on the projection screen. For example, at the focal point of the reflector or the position of maximum light, the 11-mm. carbon with its optical system gives a light at the sides equal to 70 per cent of that at the center; whereas the "Suprex" carbon gives a light of 63 per cent at the sides compared with the center.

If the positive carbon is moved either toward or away from the reflector, and the current and relative position of the negative carbon with respect to the positive are kept constant, the total light on the projection screen will change for these two carbons and optical systems according to the two top curves shown in the figure; the distribution will change as shown by the two bottom curves in the figure.

It is evident that the light falls off much more rapidly with the movement of the carbon for the 8-mm. "Suprex" combination than for the 11-mm. angular-trim non-rotating carbon combination. It is also evident that with the movement of the positive carbon, the distribution of light changes much more rapidly for the "Suprex" carbons than for the 11-mm. carbons in their respective lamp systems.

For a decrease from the maximum of 10 per cent in the total light on the screen, the 11-mm. carbon in its optical system can move over a distance along its axis approximately 60 per cent greater than that required to give the same reduction with the 8-mm. "Suprex" carbon. For a range in the side-to-center distribution ratio of light on the projection screen between 65 and 75 per cent of the 11-mm. carbon with its optical system can move twice the distance of the 8-mm. "Suprex" with its optical system.

In other words, this 11-mm. carbon with the optical system suggested gives

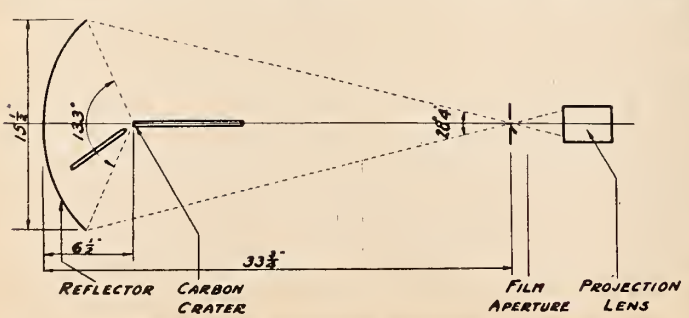


FIGURE 3

Diagram of the f/2.0 reflector arc system

a light on the projection screen which is about twice as stable with respect to carbon movement, *etc.*, as the 8-mm. "Suprex" carbon in the commercial lamps of today. At the distributions indicated by the dotted portions of the curve in the figure, the 8-mm. "Suprex" gives non-uniform color over the screen; whereas the screen distribution with the 11-mm. carbon is satisfactory over the entire range shown.

This greater "flexibility" of the 11-mm. carbon with its optical system is at least partially explained by reference to Fig. 2, where it is shown that the magnification of the optical system for the 11-mm. carbon is so chosen as to use a portion of the crater which is relatively uniform in brilliancy. With a 5.2× magnification of the crater of this carbon, the edge of the useful portion of the crater which is normally imaged on the corners of the aperture shows a reduction of only 15 per cent in brilliancy compared with the center; whereas with the 8-mm. "Suprex" crater and 6.6× magnification, this reduction is 25 per cent.

● More Light, More Heat

With the increased amount of light from the 11-mm. carbon and *f*/2.0 optical system indicated in Table C, there will be an increased amount of heat on the film. Measurements have shown that the spectral distribution of radiant energy with this 11-mm. positive carbon is similar to that of the other high-intensity arcs, and therefore the radiant energy falling on the film is approximately in proportion to the light passing through the film aperture.

Heat measurements have been made with a blackened receiver fastened to a thermocouple and mounted in the plane of the film aperture. These indicate that this 11-mm. carbon burned at 115 amperes in the *f*/2.0 reflector lamp will put about 60 to 70 per cent more radiant energy on the film aperture than the conventional mirror- or condenser-type systems indicated in Table C. It may be advisable to make special provision to take care of this increase in heat at the film aperture. Methods for doing this are well known to the industry.

A further idea of the possibilities for motion picture projection with this 11-mm. carbon and the *f*/2.0 reflector system is obtained from a consideration of the dimensions of the screen which can be adequately illuminated. Combining the data of Table B with the transmission of the film shutter, it is seen that about 8000 lumens can be put on the screen with the film shutter running and with no film in the gate.

Under the aforementioned conditions the recommendations of the S.M.P.E. Projection Practice Committee call for a screen brightness of 7 to 14 foot-lamberts. Assuming a diffusing screen of 0.75 reflectivity, it is possible to illuminate a screen approximately 34 feet in width to the minimum recommended brightness, and 24 feet in width to the maximum recommended brightness. This is about 60 to 100 per cent greater screen area than can be illuminated to this level by the reflector or condenser lamp systems in common use today.

INDUSTRY ILLS NO. 7241

Chicago circuit, already sponsoring triple-feature bills, is experimenting with four-feature shows in three other houses. Check-up reveals that 13 Chicago theatres are using triple bills, 18 advertising premiums, and 6 are handing out books. Pictures playing these theatres present "artists" whom Hollywood pays as high as $3500 a week (a week!) for their "talent"—which doesn't draw flies at the box-office.

ANOTHER SLOT-MOVIE FIRM

Another coin-in-slot movie outfit, Phon-Vision Corp. of America, has been formed in Hollywood. Sponsors say they will turn out 1000 units monthly, with West Coast product to be supplemented by Jam Handy reels. Each reel carries 10 subjects, including color. Screen is 16 by 20 inches.

CLAIMS "DEPTH" MOVIES SOON

Early advent of "three-dimensional films" was predicted by Douglas F. Winnek, New York inventor, who said his process eliminates the need for "outside agencies" such as analyzers, shades, etc. Winnek exhibits stills that have a semblance of depth, but didn't explain how he can carry over this effect to motion pictures.

NEW ALTEC CINCY DISTRICT INVOLVES PERSONNEL SHIFT

Creation of a new Altec district operation with headquarters in Cincinnati has resulted in the following shifts in personnel, effective April 1:

Warren Conner, former branch manager at Philadelphia is district manager of the new Cincinnati, with M. G. Thomas as district supervisor. D. A. Peterson and W. R. Widenor are appointed district supervisors in the Philadelphia district.

The Detroit district, which was divided to set up the Cincinnati district, remains under the supervision of District Manager F. C. Dickely. A new assignment for E. C. Shriver, formerly located in Cincinnati, will be announced shortly.

Seventeen United Detroit Theatres have renewed Altec sound service.

SMALL MULTI-RANGE AMMETER HAS BUILT-IN TRANSFORMER

Few electrical instruments are used more, in servicing or in production testing, than an ammeter. Yet ammeters providing more than a single range have always been bulky and expensive. For a long time it has been a popular kink of electrical men to dodge around this problem and increase the range of a small ammeter by hooking in a transformer.

Now Simpson Electric Co., Chicago, announces that a current transformer and an indicating instrument have been combined in a small a.c. multi-range ammeter. Known as "Micro-Tester" Model 280, this instrument provides readings in any of five different ranges, from fractions of an ampere up to 25 amperes. It is housed in a red Bakelite moulded case, with satin-finish steel front panel. Pocket-size, it measures only 2⅞" x 5¼" x 1¾", weighs just 20 ounces.

SIX BROADWAY HOUSES USE ONLY 71 FEATURES SINCE SEPT. 1

Contributing factor to the plight of subsequent-run houses in the matter of an adequate film supply is the fact that six de-luxe Broadway (N. Y. City) houses in the period from Sept. 1 last until Feb. 15 required only 71 feature films. Clearance schedules being what they are, the subsequent runs must sit tight and take whatever they can get in the way of product, sans the benefit of the exploitation accorded features around release date and by the de-luxers.

S.M.P.E. Meeting Papers Program Abstracts

(*Continued from page* 12)

tectural limit. Furthermore, such shaping can be made to function successfully if the basic design is developed to control reverberation.

The all too prevalent idea that "the more acoustical material used, the better the results" should be discouraged. Acoustical materials can be used more efficiently if they are distributed asymmetrically with due regard to the geometry of the reflecting surfaces. In general, they should not be concentrated in large compact areas on single surfaces. This principle of treatment and its effect upon the acoustical characteristics of theatres is discussed.

Instrumental measurements of the effect of surface parallelism upon the frequency reverberation characteristic of a rectangular room are shown. The results are of particular interest with respect to the acoustical treatment of preview rooms.

CURRENT PRACTICES IN BLOOPING SOUND-FILM

W. H. Offenhauser, Jr.
Bernot-Maurer Corp.

A review of our dimensional standards fails to indicate any attempt in the past to standardize sound-track bloops. While it is true that there is relatively little difficulty due to bloops at the present time, this condition appears to be due to the fact that each producing organization has more or less independently arrived at some rule-of-thumb solution to its particular problem rather than a result of any directed effort on the part of the industry as a whole.

The volume of film affected is already very large and all indications seem to point to a substantial increase in the future. With this increase in prospect, it appears that an analysis of the subject is justified in order that standardization may be accomplished when, as, and if desirable.

The criteria at the present time are almost entirely empirical; the common tests are (1) peak volume indicator and (2) listening. This has resulted in a wide variety of bloops in use; a reduction in the number of sizes and types seems desirable in the interest of simplification. For single-track negative bloop punches this is especially important.

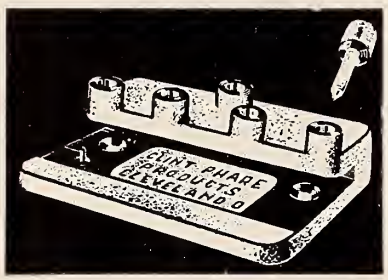
In actual use, the length of the bloop

punch varies from as small as 0.330 inch in one case to as large as 0.965 inch in another. A length of 0.500 inch may be considered to represent "average" practice. There is almost complete agreement on the following characteristics of bloop punches: (1) The punch should be sharp. (2) In the case of the triangle or trapezium types, there should be rounded corners at the base of the triangle.

There is no similar agreement in the use of bloops for sound positives; in the case of release prints, this matter is not especially pressing since release negatives are usually rerecorded and have few if any splices.

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TONE REPRODUCTION IN TELEVISION

I. G. Maloff

RCA Manufacturing Co., Inc.

The purpose of television is to produce moving pictures of original scenes in homes, auditoriums, and theatres. From the standpoint of the requirements of pictorial tone reproduction, television is closely related to motion pictures. However, the technic of tone reproduction in television is vastly different from that in motion pictures. The degree of perfection of pictorial tone reproduction of present-day television is, in some respects, not as high as that obtainable with 35 mm motion pictures. On the other hand, the medium of television is the electrical signal, which is a great deal more flexible than photographic emulsions and permits effects unobtainable with the latter.

The paper treats pictorial tone reproduction in television in detail. Means of obtaining desired range, contrast, perspective and intensity, with adequate resolution, adequate illusion of motion and freedom from flicker, are discussed. Limitations and flexibility of pictorial tone reproduction in television are described in comparison with older methods of pictorial reproduction, and typical tone reproduction characteristics of the complete television system as well as its essential components are given.

PROFESSIONAL 16-MM RECORDING EQUIPMENT

D. Canady

Canady Sound Appliance Co.

Details and description of 16-mm sound-recording equipment for professional use is given, including:

(1) A 16-mm recorder employing a high-quality optical system and glow-lamp.

(2) Sound-track optical-reduction printer, permitting 16-mm variable-density sound-track being made from either 35-mm variable-density or variable-area recorded track.

(3) Noise-reduction equipment, for use in connection with glow-lamps or the new high-pressure quartz mercury lamp.

EFFECTS OF ULTRAVIOLET LIGHT UPON VARIABLE-DENSITY RECORDING

J. G. Frayne and V. Pagliarulo

Electrical Research Products, Inc.

The effect of using ultraviolet filters upon the gamma of negative and positive development is discussed. The effect of ultraviolet light upon image quality is discussed, and a mathematical analysis is given explaining the existence of spurious side-images found in white-light recording on clear-base variable-density negatives. Low-end frequency rise, attributed to existence of these side-images, is eliminated by recording with ultraviolet.

Reduction in wave-shape distortion as well as improvement in high-frequency response attributed more to use of ultraviolet in printing than in recording. Practically no gain in signal-to-noise ratio is found by using ultraviolet in either recording or printing.

THE RCA PORTABLE TELEVISION PICK-UP EQUIPMENT

G. L. Beers, O. H. Shade and R. E. Shelby

Spot news, athletic events, parades, *etc.*, form an important source of television program material. Portable pick-up equipment suitable for televising such events has recently been developed. The equipment includes a small Iconoscope camera, camera auxiliary, camera control and synchronizing generator units, and a 325-megacycle relay transmitter and receiver. Most of the units are about the size of a large suitcase and weigh between 40 and 70 pounds. Each of the units is described and some of the practical applications of the equipment are indicated.

QUALITY IN TELEVISION PICTURES

P. C. Goldmark and J. N. Dyer

Columbia Broadcasting System, Inc.

Present television standards specify certain factors that determine the appearance of a television picture only to a limited extent. Other factors, however, such as contrast, gradation, brilliance, and the shape of the scanning spot are fully as important and are discussed in the paper.

A photographic method of producing artificial pictures that permits varying several of these factors will be explained. Pictures will be shown that were obtained by this method and approach ideal quality within a given set of standards.

A NEW METHOD OF SYNCHRONIZATION FOR TELEVISION SYSTEMS

T. T. Goldsmith, R. L. Campbell, and S. W. Stanton

Allen B. Dumont Laboratories, Inc.

Line and frame scanning frequencies in an all-electronic television system need not be frozen to a standard giving limited definition performance if the synchronizing system is arranged to allow flexible operation. Automatic operation of receiver synchronizing circuits at variable line and frame frequencies is made possible with

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the aid of a new type of synchronizing wave-form.

Synchronizing standards which permit both flexible and automatic operation are discussed. Transmitter synchronizing apparatus for flexible synchronizing standards, receiver circuits for both non-automatic and automatic synchronous operation are also discussed, and a "transition" type receiver for operation on both old and new type of synchronizing signals is briefly described.

DEFECTS IN FILM PROJECTION AND THEIR CORRECTION

I. Gordon

A statement is presented of the various kinds of damage inflicted upon screen images by oil on film. The paper enumerates the sources of this evil, the heavy loss the box-office can suffer as a result of them, the ill effect upon eyes of theatre patrons, and suggests means for reducing the evil or possibly eradicating it.

A PERSONAL SAFETY FACTOR FOR PROJECTION PRACTICE

T. P. Hover

The dangers inherent to the projection nitrocellulose film are so obvious, and the accidents, when they occur, are so spectacular that practically no attention is given to other hazards in the projection room. This is to be expected in an industry where practically no knowledge concerning the equipment and its operation ever appears to the outside world. Only the joint cooperation of the manufacturer of equipment, the sound supervisor, the theatre manager, the projectionists, and intelligent public safety officials can make the profession of projecting motion pictures a safe one. Some of the observations of the author, who is closely associated with safety officials in the State of Ohio, are given in the paper.

PROJECTION SUPERVISION, ITS PROBLEMS AND ITS IMPORTANCE

Harry Rubin

Paramount Theatres Service Corp.

The importance of thorough and continuous supervision of projection and sound equipments in theatres, some of the problems connected therewith in the construction and the maintenance of theatres; a brief outline of a few of the many details that must be examined and precautions that must be observed in order that the motion picture entertainment may be presented under the most nearly perfect conditions, are described by a projection supervisor for a theatre chain. Emphasis is placed upon the benefits to be derived through the close cooperation between the supervisor and the projection personnel of the individual theatres and several measures for accomplishing this result are cited.

PRODUCTS OF COMBUSTION OF THE CARBON ARC

A. C. Downes

National Carbon Co.

This paper is a review of work done in the laboratories of National Carbon Co., the College of Medicine of the University of Nebraska, the School of Public Health of Harvard University, and the Department of Health of the City of Detroit on the products of combustion from carbon arcs used in the motion picture industry. Analyses of the gases coming from various lamps show that, even in the stacks, the only gas occurring in toxic concentration is nitrogen dioxide.

The biological effects of undiluted stack



A swell team
in any man's theatre

The projectionist is entitled to do his work with peace of mind, with freedom from worry about the condition of the projection room equipment. Projectionists in theatres serviced by Altec recognize how much the Altec inspector's regular visits contribute to that peace of mind, that freedom from worry that make the projectionist's work easier, more effective.

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gas from simplified high-intensity arcs upon experimental animals were only those due to the nitrogen dioxide.

The arc-ash fume when administered by intratrachael and subcutaneous routes in rabbits was found to be relatively inert.

Determination of nitrogen dioxide concentrations in poorly ventilated projection rooms failed to show any concentration more than about one-fifth that generally considered as allowable for exposure of several hours duration, and therefore there is little or no hazard in these projection rooms.

Studies of ventilation under controlled conditions show that even with very low rates of both lamp house and room ventilation there is no danger of gases or fumes reaching concentrations which are toxic, and that if sufficient ventilation is provided to produce comfortable working conditions there can not be any appreciable concentrations of nitrogen dioxide or arc-ash fumes in the room.

RATING OF MOTOR-GENERATING EQUIPMENT USED FOR D. C. PROJECTION ARC LAMPS

C. C. Dash

Hertner Electric Company

The ratings of electrical equipment in general are based upon the heating and upon the performance.

The projection room duty cycle with the alternate burning of two lamps and single lamp puts a rather peculiar load upon generating equipment. This affects the temperature rating of the unit. The most important item in connection with the rating is the output characteristic. If designed for heating alone, a generator set would be unsatisfactory.

The paper considers the output characteristics desirable for use with present-day arc lamps and their effect upon the design of the unit. Motor ratings will also be discussed.

RECORDS FOR THE PROJECTIONIST

J. R. Prater

Some portions of the data necessary to good projection room records may be kept to the best advantage on blank forms. Examples are shown of such blanks adapted to (1) an inventory of projection room supplies and spare parts, (2) data on vacuum tubes, (3) exciter lamps, (4) film inspection, and (5) a cue sheet. Noteworthy features are discussed, and suggestions given for adapting these forms to individual projection rooms. Projectionists will find it easier to keep good records on appropriate forms than it is to get by without them.

RECORDING AND REPRODUCING SQUARE WAVES

D. Canady

Canady Sound Appliance Co.

A brief description of electrical equipment involved in the recording and reproduction of square waves is given.

Direct-coupled amplification is used throughout, as conventional amplifier circuits are unsatisfactory when dealing with steep wave-fronts. Toe recording has been found satisfactory as picture requirements are not involved.

Oscillograms and illustrations of mechanical wave-forms used in testing are shown and described. Records showing speech syllables passed through a conventional transformer-coupled system and direct-coupled amplifier are relatively striking and show the usual asymmetries encountered in a-c amplifiers when compared with direct-coupled systems.

MOTION PICTURE THEATRE DEVELOPMENTS

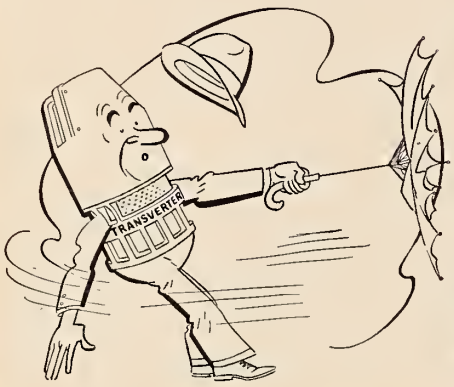
M. Rettinger

RCA Manufacturing Co.

The first part of the paper is devoted to conveying basic requirements as well as recent developments in the design of motion picture theatres with balconies to provide satisfactory conditions for all the basic considerations of proper motion picture presentation.

The second part is providing similar information pertaining to theatres with balconies. Separate sections are provided for the recommended dimensional and constructional features of balcony depth, soffit, and

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height; of the theatre ceiling, sidewalls and rear wall; and of the space above the balcony.

OPTIMUM LOAD IMPEDANCE FOR FEEDBACK AMPLIFIERS

B. F. Miller

Warner Bros.-First National Studios

The apparent plate-resistance of vacuum-tubes employed in inverse feedback amplifier stages is shown to be a function of the degree of feedback employed. Equations for predicting the optimum value of amplifier load impedance for maximum undistorted power output are derived, and the necessity for properly building out the amplifier load circuit is demonstrated. A basic circuit, employing a combination of two feed back elements is indicated, which permits securing the maximum undistorted power output from an amplifier stage while maintaining proper impedance relationships between amplifier and load circuits without the use of building-out resistors.

AUDIENCE NOISE AS A LIMITATION TO THE PERMISSIBLE VOLUME RANGE OF DIALOG

W. A. Mueller

Warner Bros.-First National Studios

A series of noise measurements were made in theatres to determine the cause of low intelligibility of dialog recordings of wide volume range. Audience noise level was found to be a serious restriction, because it averages 8 db louder than film noise level and reduces the useful volume range by that amount.

Audience noise is an extremely variable factor, as measurements made in the same theatre showed it to be as low as the film noise in one instance and later to rise 14 db above this value. To secure good intelligibility, the volume range of the dialog must be compressed so that the softest-spoken words never are so low in level as to be seriously masked by audience noise.

CYCLEX SYSTEM OF PROJECTION

C. S. Ashcraft

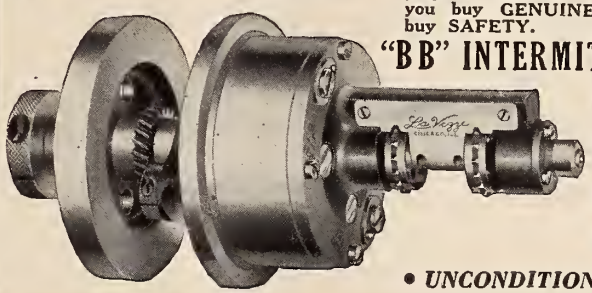
Ashcraft Manufacturing Corp.

Cyclex is a method of light projection particularly adapted to the projection of motion pictures. It is based on a method of coordinating light impulses, whereby a.c. may be used for the production of an electric arc and the light therefrom projected through a rotating shutter upon a screen, with a total absence of the periodic visual beat which has heretofore characterized a.c. projection arcs.

Simultaneously with the development of the non-pulsating a.c. projection system has been the development of a distinctly new type of alternating current arc, wherein the characteristics of the arc itself have

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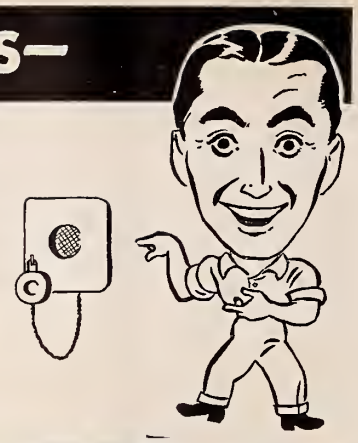
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NATIONAL THEATRE SUPPLY COMPANY

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These films have been prepared under the supervision of the Projection Practice Committee of the Society of Motion Picture Engineers, and are designed to be used in theaters, review rooms, exchanges, laboratories, factories, and the like for testing the performance of projectors.

Only complete reels, as described below, are available (no short sections or single frequencies). The prices given include shipping charges to all points within the United States; shipping charges to other countries are additional.

35-Mm. Visual Film

Approximately 500 feet long, consisting of special targets with the aid of which travel-ghost, marginal and radial lens aberrations, definition, picture jump, and film weave may be detected and corrected.

Price $37.50 each.

16-Mm. Sound-Film

Approximately 400 feet long, consisting of recordings of several speaking voices, piano, and orchestra; buzz-track; fixed frequencies for focusing sound optical system; fixed frequencies at constant level, for determining reproducer characteristics, frequency range, flutter, sound-track adjustment, 60- or 96-cycle modulation, etc.

The recorded frequency range of the voice and music extends to 6000 cps.; the constant-amplitude frequencies are in 11 steps from 50 cps. to 6000 cps.

Price $25.00 each.

16-Mm. Visual Film

An optical reduction of the 35-mm. visual test-film, identical as to contents and approximately 400 feet long.

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SOCIETY OF MOTION PICTURE ENGINEERS

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been used to the best advantage. Heretofore the method of operating a.c. arcs has not been conducive to obtaining the highest efficiency and economy. The new *Cyclex* arc, however, has resulted in a light-source producing a far greater screen brilliancy together with a greatly reduced power input and consequent carbon consumption.

The practical application of the combination necessitated the development of a radically new type of power conversion equipment, particularly adapted to the operation of the new arc. This equipment must have such characteristics that coordinated light impulses may be obtained with the maximum of electrical and mechanical efficiency, simplicity, flexibility.

The purpose of the present paper is (*a*) to present the basic theory of the system. (*b*) explain the characteristics of the *Cyclex* arc, together with the quality of the light produced, and (*c*) describe the apparatus employed for flexible frequency conversion and method of polyphase current transformation for the arc supply.

TELEVISION PICK-UP OF THE PASADENA ROSE TOURNAMENT PARADE

H. R. Lubcke

Don Lee Broadcasting System

The first television pick-up of the Pasadena Rose Tournament Parade was made on Jan. 1, 1940, with the "suitcase" type portable television equipment and beam transmitter *W6XDU* of the Don Lee Broadcasting System.

Two television cameras were used to give long-shot and close-up views of the floats; the cameras being arranged to give instantaneous switching of scene. The distance from Pasadena to the Don Lee Building, site of the home transmitter is nine miles and the line of sight was interrupted by two hills and buildings. Since the portable transmitter operates on a wavelength of less than one meter, much effort was therefore directed toward erecting high and efficient antennas at the transmitter and receiver.

Diathermy machines, as used by the medical profession, were found to cause interference even on the beam transmitter frequency of 324 megacycles, indicating the need for proper shielding of such devices.

The sound portion of the broadcast was sent over the nationwide Mutual Network. Camera work and aural description were adequately synchronized. Although rain fell during the parade and the morning was darkly overcast, written statements of reception from lookers up to 15 miles away reported clear images, enabling them to read the names on the floats and discern other items of detail.

SPEED UP YOUR LENS SYSTEM

W. C. Miller

Paramount Pictures, Inc.

The tendency of bare glass surfaces to reflect light has always presented a serious problem in optics. New discoveries in the field of physics have resulted in methods of reducing these light reflections. One of these methods has proved practicable for general use in optical equipment. The reduction of reflections in treated systems has been so great that ghosts and flares are rarely encountered. The light no longer reflected by the glass surfaces is transmitted by the optical systems, increasing their efficiency.

Camera lenses treated with the new process show an increase in speed of nearly a full stop. New applications of the process are being found almost daily.

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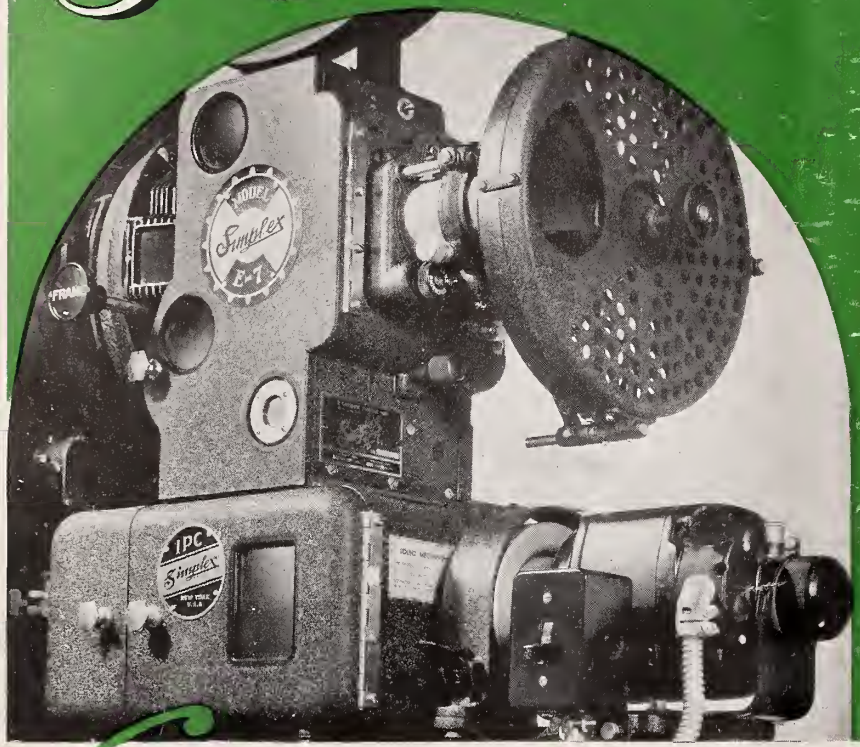
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APRIL 1940

VOLUME 15 • NUMBER 4

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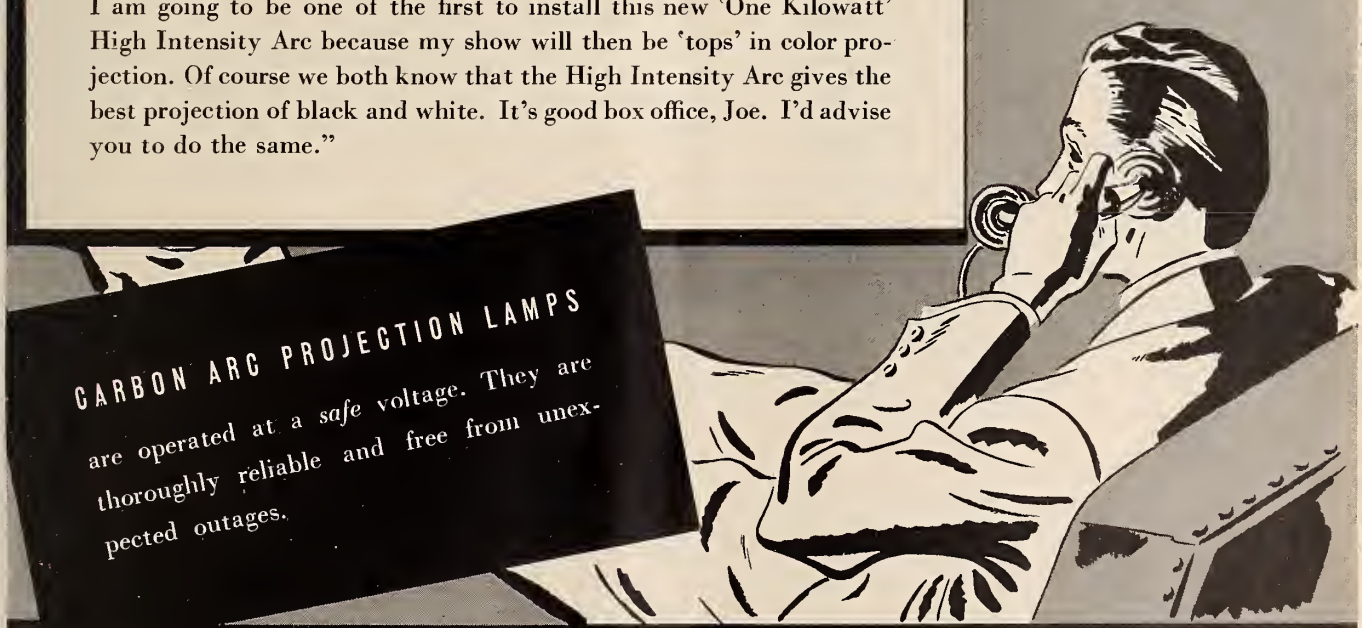
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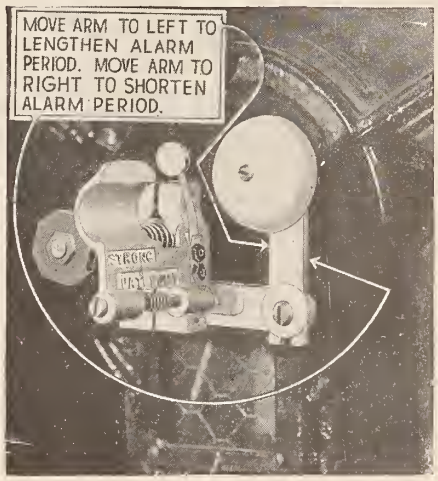
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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

THEATRE television, coated lenses, stereophonic sound recording and reproduction, the Disney auditoria perspective idea—these are just a few of the items with which the industry's technical brains (the word "technical" may be superfluous) are wrestling at the moment. All of them affect intimately the projectionist, particularly theatre television. The latter was all primed to go early this Fall, until the current F.C.C. fuss developed.

Chief stumbling block at the moment is the quality and price of receivers—improvement in the one and revision downward of the other being chief recommendations of the F.C.C. It is known that RCA plans vigorous promotion of the theatre field, but it would not be surprising if an important Broadway house were selected as the scene of the first such trials before this year is out.

Anent coated lenses, I. P. has reports of some rather peculiar behavior by such units. Slight variances in light transmission as between two projectors in a given theatre are of course permissible; yet these lenses seem to give altogether disimilar results in different houses. Maybe the method of coating, or even auditorium characteristics, affect the net result obtained, but whatever the reason the process must be exact to within small tolerance to be of any value to the industry as a whole.

Disney's stunt, which we suspect involves multiple horns in the auditorium, evidently will be confined to so-called de luxe houses, since it requires the installation of very special accessory equipment. Stereophonic sound still is only a promise in the reproduction field.

Just a few more attachments to the projector, plus a bit more accessory equipment, and projectionists will need a guide book to find their way about a theatre.

• • •

Eight projectionist organizations have responded favorably to our suggestion regarding enforced pre-show inspection of all film by the man on the job, plus periodic inspection of the equipment itself. This is only a fair start for an idea that we consider has real merit in that it protects both the worker and the organization. We're confident that after the plan is in effect for a short while in various localities the other groups will realize its benefits and subscribe thereto. Maybe a few unfortunate experiences plus the receipt of a few bills for damaged film will turn the trick.

The present economy wave sweeping over the industry, with a certain reduction of prints, isn't calculated to improve matters any.

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I. P. again offers its facilities to N. Y. World's Fair visitors in the matter of reservations, information, etc.

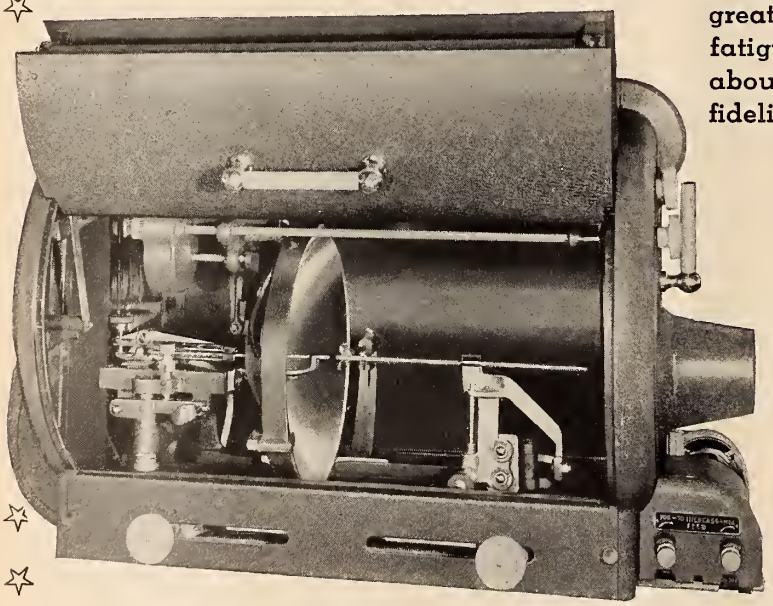


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VOLUME XV APRIL 1940 NUMBER 4

Emergency Operation of Sound Systems

By *PAUL P. MELROY*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

EQUIPMENT subject to repeated break-downs and erratic operation produces dissatisfaction and ultimate loss in patronage. To be more specific, a sound outage means loss of customers and refund of admissions, the amount of which depends on the size of the house and the duration of the outage. Fortunately, continued improvement in the design and manufacture of sound reproducers has helped greatly to make such incidents much less frequent, but other factors, such as lack of periodic inspection and proper maintenance, abnormal power surges, and abuse in operation, still cause unexpected and costly failures.

However, to meet the ever-present possibility of an outage, equipments of recent design have emergency circuits built in at the factory—the result of the coordinated efforts of projectionists, design and field engineers. In addition, older sound systems which are under the scheduled attention of field engineers have undergone changes to include similar stand-by circuits, wherever such improvements were possible.

Since no amount of emergency circuit adaptations to any single channel system will provide 100 per cent protection against possible sound outage, there has been a wide-spread demand for the RCA Emergency Sound System, Type PG-109. The increasing popularity of this particular emergency system is due to the ease and simplicity with which it is placed in operation, its complete coverage against failure in any type of sound equipment (excluding mechanical failure of soundheads), and its low rental cost. Details of this equipment were published in the January issue of I. P. under the title "A Portable Emergency Sound System."

Even though emergency circuits or separate protective systems are available and have become established, their universal addition to existing systems will not be an overnight affair. So, we must continue to give consideration to the projectionist who still is confronted with possible emergency situations in which sound restoration depends entirely upon his own ingenuity.

The rapidity with which he finds the trouble depends on the personal interest he has taken in his equipment and if he has learned how each unit works, the order in which they work together, and his previous training. Systematic checking of units in logical order will usually reveal the offending unit. The remedy applied may be simple, but many times requires a bag of tricks filled by study and experience.

● Know Components Thoroughly

The first duty of a projectionist is to become thoroughly acquainted with all the equipment under his control. Mechanical systems of projectors and arc lamps are not so complex as to require unusual study to acquire a good workable understanding of its operation, although a sharply defined, evenly illuminated picture is every bit as important as well-controlled sound. The particular sound system at hand does not differ basically from thousands of others in operation, but it does have its own particular layout, fitted to that theatre, with consequent physical differences which do require careful attention. It is much better to familiarize oneself with the equipment at leisure than to be suddenly called upon under pressure of a theatre full of whistling and stamping patrons.

A general inspection will reveal the location of all associated units such as pre-amplifiers, sound transfer switches, main amplifier, loud speaker control switches, exciter lamp and speaker field power supply units, and the main a.c. power supply source. Once these are located, a further reference to the installation wiring sketch, or preferably a block diagram, will show the logical order in which the various units work together.

Determine whether the tubes have a.c. or d.c. filaments; whether the plate voltage supply is a part of the amplifier unit or originates from some separate power unit; whether the exciter lamps are a.c. or d.c., and whether the stage speakers have separately excited or permanent magnet fields. Then there should be a very close examination to learn the whereabouts of all fuses, ignorance of which has been *the source of the highest percentage of all emergency calls.*

Of particular importance is an acquaintance with all existing emergency devices, which vary according to the type and age of the main system. Separate cable assemblies with clips for attaching to various terminals, standby switches attached to the main system,

duplicate standby units, or a complete separate system either permanently installed or portable may be found. In whatever form these emergency expedients may be, the projectionist should find out all about them, put them into operation by frequent rehearsal, so that a smooth and prompt changeover is made when stand-by circuits become necessary.

● Instruct Relief Man

Frequently, when emergency situations do arise, it is the relief man who is on duty. Some of the trouble may be caused by his inexperience of operating that particular equipment. Often, he does not know how to put the standby equipment in operation, because he never received adequate instructions. Emergency rehearsals should be attended by all men who operate the equipment, not forgetting the stagehands when loudspeakers and associated stage equipment are involved.

● Manufacturer's Cooperation

No one is more conscious of the necessity of proper emergency protection for sound than the field engineer. His daily routine not only centers on maintaining the highest sound quality, but includes a responsibility for recommending means for achieving the greatest possible insurance against failures. Still, his job is not finished until all projectionists have been thoroughly rehearsed and have received a full explanation of the whys and wherefores of the added protective circuits or equipment. His recommendations for spare parts should not be dismissed lightly, because these are the first essentials of any emergency protective system.

All theatres should know how to contact quickly their nearest sound engineer. When in urgent need for assistance, have all details regarding the nature of trouble available for transmittal to the engineer. Frequently, precious time has been saved by 'phoning a detailed description of the trouble to an engineer, who immediately diagnosed the case and gave instructions as to how the fault could be overcome for temporary restoration of sound. The projectionist should always be the one to 'phone, because of his superior knowledge and his ability to follow the engineer's instructions. In serious breakdowns, the engineer will also know what replacement units should be brought along from the local emergency stock.

● Basic Unit Analysis

To establish a systematic routine of searching for trouble, it would be well to look first at a block diagram of a film sound reproducing system, and follow the path of the signal from its source to the stage speakers. As all systems are basically the same, a simple sketch showing soundheads, amplifiers, and speakers will serve (Fig. 1). Incidentally, each projection room should have a similar diagram covering the particular equipment there installed, showing all components, with dotted lines to indicate the alternate routing of signal during emergency operation. Fig. 2 is a concrete example, showing a PG-140 RCA system, with all emergency circuits, switches, and fuses clearly marked.

In Fig. 1, sound originates in the soundhead at a very low average level of approximately minus 55 db. The fader, moved to the proper position corresponding to the projector in operation, passes the signal into the voltage amplifier, excluding signals from the other soundhead which might be generated while threading film.

The voltage amplifier steps up the signal from minus 55 db to approximately zero db level, indicating an increase in gain of 55 db for that particular setting of the volume control located in the voltage amplifier. With maximum volume control setting, the total voltage amplifier gain might be 85 db. Returning to the signal under normal operation, it leaves the voltage amplifier at zero db level and directly enters the power amplifier where it is again stepped up approximately 25 db to an output level of plus 25 db, equivalent to 4 watts of power (12.5 mw. reference level).

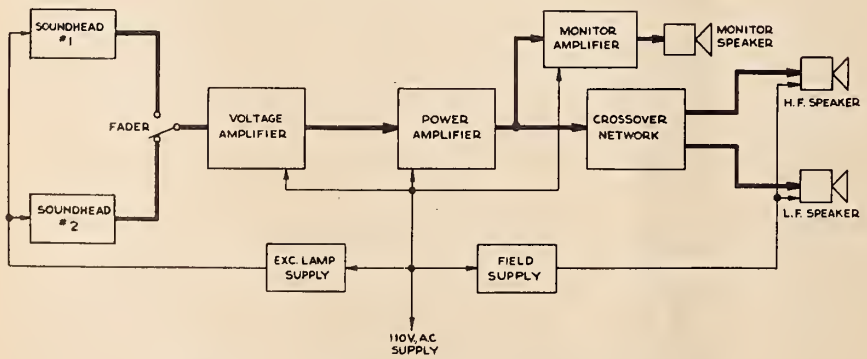


FIGURE 1. *Block diagram of typical sound system*

Then it enters the crossover network, which acts as a divider, in which all signals above 400 cycles are passed along to the high-frequency loudspeaker, and all signals lower than 400 cycles are passed along a second line to the low-frequency speaker. The projection room monitor amplifiers and speaker is connected to the power amplifier output, so that it will be fed through the same channel that feeds the stage speakers to reflect a true duplication of signals delivered to the stage. So much for the signal path. But what about the power circuits?

The 110-volt a.c. supply feeds the voltage, power, and monitor amplifiers, also the exciter lamp supply unit and the loudspeaker field supply unit. Each amplifier unit has its individual power supply system which feeds a.c. filament voltage and d.c. plate and grid voltages to its respective tubes. The polarizing d.c. voltage for the soundhead phototubes usually is supplied by the voltage amplifier.

The exciter lamp supply unit converts the main a.c. supply into a low d.c. voltage and feeds the exciter lamps in the soundheads. The field supply unit likewise converts the main a.c. supply into d.c. of the proper voltage to excite the field of the stage speaker units. The projection room monitor has a permanent magnet field requiring no external d.c. supply.

Thus, with a knowledge of the logical order of units in the signal path and of how the various essential power supplies are obtained, the task of quickly locating a defect is made simple.

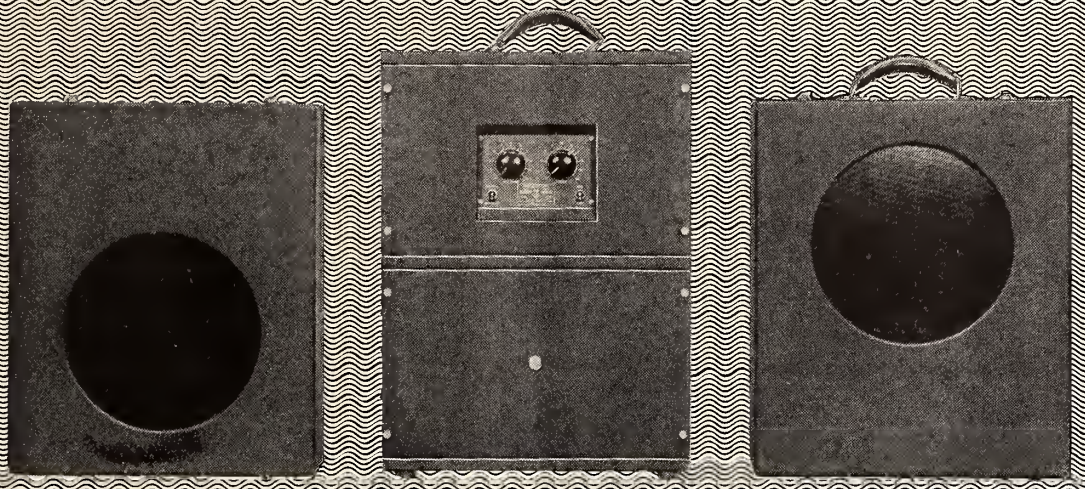
● Locating the Defect

When sound is lost, the first check should be of the a.c. power supply to the sound system. A pilot light on the load side of the line fuse is a good indicator for rapid check. If the power supply is normal, then the job boils down to locating the unit in which the defect exists. This requires a cool head for quick thinking and a steady hand for systematic, rapid checking. Bearing in mind the most common sources of trouble, the method of search should adhere to the following procedure:

Look at exciter lamp for possible burn-out. Remove film from the rotary stabilizer drum or sound gate and place a white card in front of phototube to see if light is striking cell; this double-checks the position of exciter lamp and determines as well whether any foreign material is obstructing the light between the lamp and phototube. Operate the fader potentiometer or fader switch several times to eliminate possible poor or dirty contact in sound changeover. Fade to the second projector and suc-

Looking at the sound picture  *from the projectionist's port-hole*

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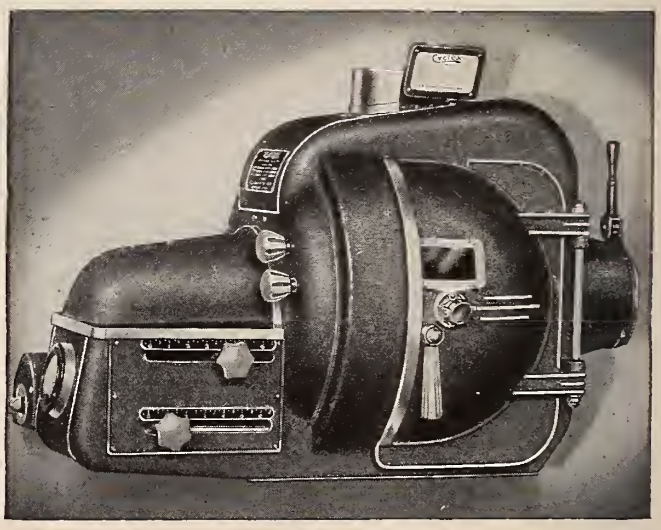
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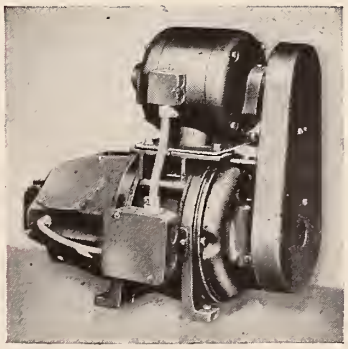
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cessively interrupt the exciter light beam in the second soundhead, listening for the familiar "plopping" in the monitor speaker. This identifies trouble localized in one soundhead.

If trouble still persists, turn up the main volume control and gently tap the input (first) tube in the voltage amplifier. This should produce a thump in the monitor speaker, indicating trouble in the input circuits previous to the amplifier—probably loss of phototube polarizing voltage or open or short-circuit in the fader system. If no sound is produced by tapping the input tube while volume control is advanced, then trouble exists in the voltage or power amplifiers or speaker circuits.

In general, trouble in the stage speakers or speaker crossover will be evident by normal signal from the monitor speaker only. If monitor and stage speakers are all dead (when tapping the input tube) the trouble is doubtlessly in the amplifier units. If only the stage speakers are dead, the bug may be in the field supply or speaker crossover. or stage-run wiring, as it is unusual for all voice coils to open simultaneously. Failure of the high-frequency speaker units only results in heavy unintelligible sound in the auditorium.

In the foregoing routine, a logical order has been followed from soundhead to speakers, to tie the trouble down to some specific unit in the system. Once the unit is identified, then an attempt should be made to find which part is at fault. Check all fuses, replace tubes, and search for broken wires or loose terminals. Frequently, the failure of some parts can be detected by touch or smell due to development of high temperature. If this simple and quick checking does not produce results, it will be necessary to resort to a substitution of reserve units or a rerouting of signal.

● Temporary Sound Restoration

Failure of both soundheads simultaneously is rare, but such cases are mainly due to an interruption of exciter lamp or phototube polarizing voltages. Exciter lamp supply failure can be overcome by using a suitable transformer to feed a.c. of the proper voltage directly to the lamp. Lamps which draw a comparatively small current may cause an appreciable a.c. hum in the system when so operated, although the heavier current lamp of 5 amps. or greater will give acceptable results.

Another method is to transfer the output leads from the dead exciter lamp supply unit to a storage battery of suitable voltage and capacity, using one lamp at a time to conserve battery energy. To restore polarizing voltage to phototubes, the supply leads should be removed from the normal source and connected to a suitable "B" battery, usually 90 volts, making sure of proper polarity as well as connecting one side to a proper point in the system.

Failure of one soundhead can be due to many sources, with a resulting wide variety of means to restore sound. Making sure that a good lamp is in proper position and that the light beam is striking the phototube, it is simple to next replace the phototube itself. Inasmuch as the other soundhead produces sound, it is assumed that the polarizing voltage is normal. The defect is then probably in the coupling circuit between the phototube and the fader—an open, short, or ground in the p.e.c. transformer or low-capacity cable.

In such cases, phototube outputs may be paralleled by adding shielding wires between soundhead circuits. keeping the fader in the good projector position and fading with exciter lamps. Details as to how phototube circuits may be paralleled vary according to type of system, and local RCA service engineers should be consulted for this advice.

Fader or sound changeover failures are commonly due to dirty or open contacts, open, shorts, or ground in the signal line. If none of these can be located, the fader unit usually may be completely eliminated by removing the fader input and output leads and connecting them together. When this expedient is used, any grounded sides should be tied together.

Voltage amplifier failure is serious, as this is an essential unit in the signal circuit and impossible to eliminate. If replacement of tubes or fuses does not restore sound, its defective part must be located and repaired, or a complete spare unit must be substituted. In Fig. 1 the monitor amplifier might be substituted for the voltage amplifier, provided its input and output impedances and overall gain were suitable and the phototube polarizing voltage were supplied from "B" batteries. Needless to say, the voltage amplifier in a single-channel system presents the greatest hazard to emergency operation.

Power amplifier failure is not so serious, as in many systems the gain and power delivered from the voltage amplifier will operate the stage speakers temporarily. To eliminate the power amplifier from the circuit, its output leads are transferred to the proper impedance taps of the voltage amplifier output, and the leads are removed from the power amplifier input. This normally requires an advanced setting of the main volume control to obtain sufficient gain. Emergency switches are usually permanently added to such systems, so that a rapid changeover to this emergency circuit can be had.

Obviously, if the voltage amplifier is the type that gets its filament and plate voltages from the power amplifier, then failure of either amplifier unit means a sound outage until the defect is repaired or another suitable complete amplifier is substituted.

Loudspeaker crossover network failure is most easily overcome by eliminating the unit entirely and operating temporarily on the low-frequency loudspeakers only. In case the crossover does not have a switch already provided to make this change, it can be accomplished by connecting the input leads directly to the low-frequency speaker network. Under no condition, should both high- and low-frequency speakers be connected directly to the amplifier output, as the signals below 400 cycles will probably cause damage to the high-frequency speaker voice coils.

Speaker field supply failure which persists after rectifier tubes and fuses have been replaced, may be quickly overcome by transferring the d.c. output leads from the faulty field supply unit to the d.c. arc supply, provided the speaker fields have the usual 100-volt rating. Best emergency operation will result in connecting the fields directly across the arc generator rather than across the arc lamp. because of the higher d.c. voltage on the line side of the ballast resistors in the arc supply circuit. In case the speaker fields are rated at 13 or 15 volts, storage batteries may be used, or the d.c. arc supply can again be used with a suitable resistor to drop the voltage to its proper value.

Loudspeaker failure involves either

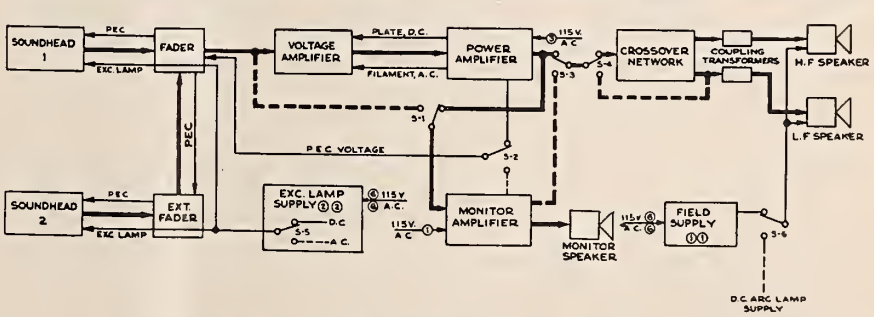


FIGURE 2. *Functional diagram of RCA PG 140 system*

voice coil or field winding, both of which may be replaced in later-type speaker units. In many early-type units, the field winding was an integral part of the speaker assembly where failure made a complete replacement necessary. In two-way speaker systems, simultaneous failure of all voice coils has never been reported. It is usually the high-frequency units which fail because of excessive signal level applied, leaving the low-frequency units operative.

As previously mentioned, the low-frequency units should then be connected directly to the amplifier output, eliminating the crossover network, thus feeding the full frequency range to the low-frequency units. Failure of all low-frequency units is not so serious, as the show may continue with intelligible sound on the high-frequency units as normally connected. Damaged low-frequency units should be disconnected from the crossover network to eliminate possible shorts or grounds.

In systems where two-way speakers are not used, simultaneous failure of all speaker units has occurred. In this case, the only remedy is immediate repair or unit replacement. Occasionally the monitor speaker unit has been installed on the stage as a temporary measure during repair of regular speakers.

The foregoing is a simple analysis of a typical sound system to show what each unit does and how it is or is not affected by the failure of some other unit in the complete system. Methods to locate the faulty unit and the common short-cuts to restore sound have been described. Emphasis has been placed on the necessity of setting up protective stand-by circuits wherever possible to avoid confusion and insure quick restoration of sound when failure occurs.

However, these very essential reserves seldom give as much assurance or peace of mind as is enjoyed by doing everything possible to *prevent* failures. Prevention of emergency situations is best accomplished by periodic inspection and checking of the complete sound system by a service engineer. His maintenance program provides automatic replacement of worn parts, which not only guards against failures, but keeps the system operating with top-notch sound quality. Thus, competent regular service combined with an adequate stand-by system gives an unquestionable reliability to sound equipment, so essential to keep the show going.

M. P. Deming, field engineer for RCA Mfg. Co., is observing his 12th anniversary as a sound system serviceman in the Brooklyn, N. Y. territory.

New Low-Reflection Lens Shown to S.M.P.E. Group

A NEW type of motion picture projector lens which reduces light reflection losses and thereby increases the amount of light projected on the screen was explained and demonstrated recently to the Atlantic Coast Section of the S.M.P.E. by Prof. C. H. Cartwright, of Massachusetts Institute of Technology.

Dr. Cartwright's researches in the treatment of lenses with low-reflection homogeneous film are well known. In a laboratory demonstration he showed the engineers the extent to which the light-transmission efficiency of lenses may be increased by treating it with the film he has developed.

● Great Improvement Noted

The demonstration showed the difference between the new film-treated lens and a standard projection lens. Two matched films of the same subject were projected simultaneously upon a single screen by two projectors, one equipped with a treated lens, the other with an untreated lens. Half the film was masked in each projector, and the halves were matched on the screen, allowing visual comparison of the light-transmission of the two lenses. The difference in amount of light transmitted and in picture detail was pronounced.

Summarzing his paper, Dr. Cartwright said:

"A homogeneous film that reduces reflection to zero for one particular wave-length of light must satisfy two conditions: (1) the index of refraction must be equal to the square foot of that of the glass, and (2) it must have an optical thickness of one-fourth of the wave-length of the incident light.

"The first condition is difficult to fulfill exactly because it requires a film of an abnormally low index of refraction. Even when this condition is satisfied only approximately, however, a marked decrease in the reflection from glass is possible. The second requirement is of paramount importance. Although it may be fulfilled exactly for only one wave-length, the reflectance is greatly reduced throughout the spectral range used for most visual and photographic purposes. These two conditions can be satisfied rather well by evaporated films of the metallic fluorides deposited on glass in vacuum.

"Although each air-glass surface of an optical system reflects only about 5%, there are enough surfaces in a camera lens or projecting lens so that the transmission of light is noticeably increased after a lens is treated. More striking than the increase in transmission is the improved quality of the pictures made with a treated lens."

Disney Won't Tell About 'Fantasia'—But I.P. Will

THE charming Walt Disney announces an "entirely new departure in screen entertainment" in a "limited number of theatres" in connection with the release next October of *Fantasia*, which is described not as a cartoon nor as a "picture with live talent" but as an "entertainment enterprise."

The picture, if Mr. Disney will permit the term apropos his "enterprise," can only be roadshown, because special reproducing equipment must be installed for each booking. Nothing like this 2½-hour show has been attempted before, says the cartoon maestro. More than 450,000 feet of sound track for musical background has been shot, "mixed" and assembled for *Fantasia*. It's all a deep, dark seeret, says Disney.

[ED.'S NOTE: *It wouldn't be one of these multiple sound tracks with which you have been playing in cooperation with RCA, with the reproduction utilizing multiple horns spotted about the auditorium instead of flyed behind the screen—now, would it, Walt?*]

EMERGENCY SET UP TO FULL LOAD IN 2 SECONDS

An auxiliary lighting system, recently installed in a new Lynn, Mass., high school passed its initial tests with flying colors when it came from "start" to "full load" in less than two seconds. Such performance has important implications for motion picture theatres. Manufacturer's guarantees on this emergency equipment, which was installed in compliance with State law, embraced a time elapse of 15 seconds from power failure until the generator was carrying normal voltage.

The equipment consists of a General Electric 7½-kw, 115-volt, d.c. generator driven by a Hercules gasoline engine.

Almost Instantaneous Operation

In testing the set it was found that the lag was four seconds on the first start. As the engine gas line had been completely drained for shipment, it was felt that part of the time required to start the set was consumed in filling the carburetor bowl. On the next trial the set was stopped within a short time after it had been started and then re-started. On this trial and all subsequent tests the time elapse, from the failure of the normal power until the emergency circuit was carrying full load, was less than two seconds.

Another feature of this installation is the isolation of vibration. To minimize the vibration the generator set was mounted in a shallow concrete pit lined with cork. The exhaust from the engine was run through a Maxim silencer. This is the first of two similar installations in Lynn, the second of which will have a generating set rated at five kw.

MORE THAN SPECIAL ABILITY

TRADITIONAL Eastman uniformity backs up each film's special ability. That's why cameramen place utmost confidence in the three Eastman negative films — Plus-X, Super-XX, and Background-X. This reliability has made them the raw-film favorites of the industry. Eastman Kodak Co., Rochester, N. Y.

J. E. BRULATOUR, INC., ***Distributors***

Fort Lee **Chicago** **Hollywood**

PLUS-X
for general studio use

SUPER-XX
for all difficult shots

BACKGROUND-X
for backgrounds and general exterior work

EASTMAN NEGATIVE FILMS

Stereophonic Reproduction From Film

By *Dr. HARVEY FLETCHER*

DIRECTOR OF PHYSICAL RESEARCH, BELL TELEPHONE LABORATORIES

SYMPHONIC music heard over radio or the loudspeakers of sound-picture systems, although very satisfactory, fails to produce in several respects the effect received by one listening to the original production in an auditorium. A full symphony orchestra utilizes air vibrations at nearly all the frequencies the ear can hear, and it uses volumes of sound from about the lowest that can be heard in an ordinary auditorium to volumes one-hundred million times greater.

The frequency range of such an orchestra, in other words, runs from the neighborhood of 40 cycles per second to perhaps 14,000 cycles, and the volume range extends from about 30 db above the threshold of hearing to 110 db, a total range of 80 db.

In contrast with these ranges radio and sound-picture systems have frequency ranges only from 5,000 to 8,000 cycles wide, and volume ranges from 35 to 50 db. Moreover a listener in an auditorium receives an added effect from the distribution of the sound in space, a recognition of different sounds coming from different sources.

● Stereophonic System

These limitations have long been recognized by the Bell Telephone Laboratories, and some years ago an improved sound-reproducing system was developed. The result of this work was the stereophonic system demonstrated in Washington and Philadelphia in 1933.

Besides reproducing practically the complete frequency range of the orchestra and an enhanced volume range, this system went further in interposing frequency and volume control between the pick-up microphones and the loudspeakers to permit the conductor the secure effects unobtainable from the orchestra alone. The music was picked up by three microphones spaced across the front of the stage, and the outputs from the microphones were carried through separate channels and control equipment to three loudspeakers spaced across the stage of the auditorium where the reproduction took place.

In the demonstration seven years ago, the music was reproduced at a distance from the orchestra but at the same time at which it was being played. On April 9 of this year a new stereophonic system was demonstrated in N. Y. City, into which another set of steps has been introduced. The music is recorded on film, and is then available for reproduction from the film at any time. Four sound tracks are placed on a single film; one is used for each of the three program channels, and the fourth serves for a control signal. A section of the film is shown in Fig. 1.

This recording on film might seem a simple thing to do. With music and sound so universally recorded on film for sound pictures, there would seem little difficulty to those not technically familiar with sound-picture systems in recording and reproducing a three-channel stereophonic program. The facts are, however, that ordinary recording and reproduction places no such demands on the equipment as does the stereophonic system.

● More Severe Demands

Sound-picture systems transmit a frequency range of less than 8,000 cycles; while the stereophonic systems employ a band nearly twice as wide. The entire recording and reproducing system had to be designed for this greater range. In addition much greater precautions had to be taken to reduce noise and distortion. An extremely quiet system is required so that music at very low volumes, much lower than used in sound-picture systems, is not marred by the noise, and this is made more difficult because of the wider frequency range, which gives a wider band for the entrance of noise. In addition there is the matter of in-

Stereophonic sound involves the recording of the original sound through three microphones placed respectively at right, center and left of a stage. Currents from each microphone are amplified and recorded on three separate film sound tracks. Since an orchestra or an organ has a range of loudness very much greater than can be recorded without distortion on a photographic film, it is necessary to "compress" the original range of sounds before recording. On a fourth track, account is kept of the amount of compression, as an automatic control for the "expansion" of volume range which must be made in reproduction.

When the film is run through the reproducer, three separate sound currents are created, each of which actuates its own set of loud speakers, located at right, center and left of the stage. This arrangement, together with the wide frequency and volume range of the system, gives to the music "spatial" quality.

The system as demonstrated in New York is of enormous power and beautiful quality, but, as its sponsors admit, its practical application in the motion picture industry is extremely doubtful at present.

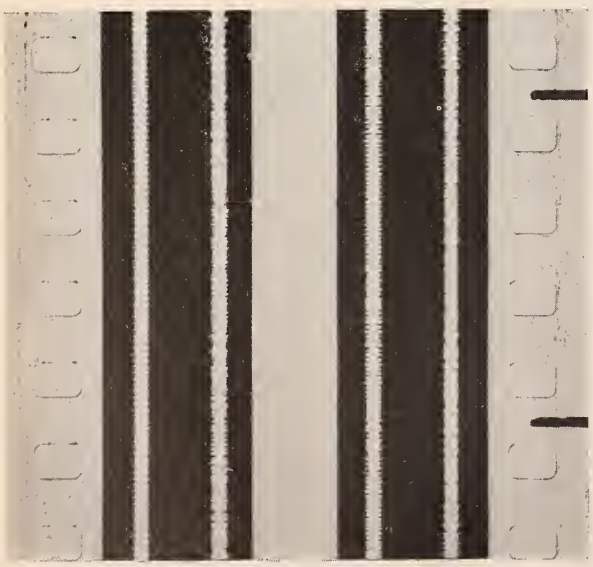
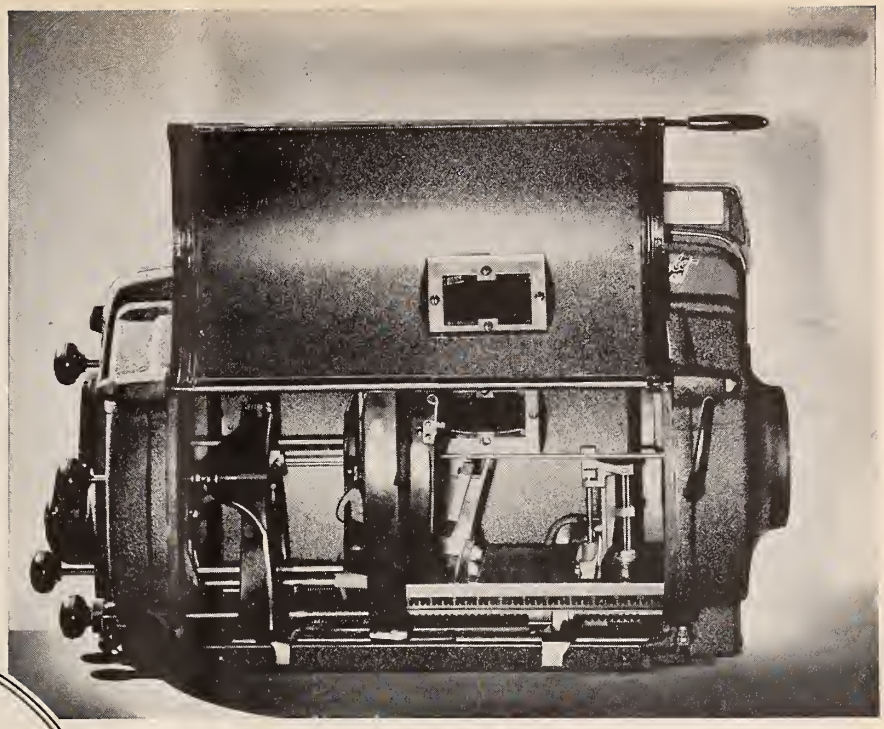


FIGURE 2

Enlarged photograph of film negative as used in final reproduction



THIS IS THE LAMP

• • • that is putting high intensity projection lighting within the reach of moderate size theatres heretofore restricted to the use of low intensity lamps, because the operating, if not the original, cost of the earlier high intensities has been prohibitive.

The New 19000 Series

Simplex HIGH

is a low cost, direct current projection arc of intermediate capacity designed especially for theatres of up to 800 seats and using screens as large as 18 feet in width.

Although the Simplex High projects twice as much light as the low intensity, the over-all operating costs are only slightly higher, because this new arc operates at only 27 volts as compared to 55 volts in the low intensity, and each 14-inch 7 m.m. Suprex positive carbon burns for at least two hours.

This Simplex High projects the snow-white light characteristic of the high intensity arc which is so necessary to the projection of colored pictures.

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Now After Exhaustive Comparative Tests

FILM-WELD

Successor to Film Cement

Is adopted as Standard by

WARNER BROTHERS EXCHANGES

Exchange work makes exacting demands upon a film binding agent. The splice must be made secure—and quickly. Now, in Warner exchanges splices are made the modern way—with FILM-WELD, the successor to film cement. Now, America's theatres receive Warner reels with thinner yet more rugged splices.

This progressive move by Warner exchanges was the inevitable result of a series of exacting and exhaustive tests during which all makes of film cement and FILM-WELD were put to the acid test. FILM-WELD's superiority on all counts was overwhelmingly established.

And why not? Warner exchanges now need not empty their cement bottles twice daily, nor be careful not to expose too much cement at one time. Because FILM-WELD does not thicken, spoil or discolor—even when exposed to the air. It retains its full strength down to the last drop, requiring no thinning agent. It firmly binds all film—nitrate, acetate, black-and-white and color. It goes twice as far as ordinary film cement—naturally.

First proven best on the projection firing line in thousands of theatres, FILM-WELD now delivers perfect results in major exchanges. And Warner is but the first such group to adopt FILM-WELD—more are on the way. Get your FILM-WELD from any one of the 108 dealers throughout America who now stock this modern splicing agent.

Instructions for use

FILM-WELD should never be put into a container that has been used for film cement, or a brush used that has been used with film cement. Use FILM-WELD sparingly; just enough to moisten the film is sufficient, as any excess slows up the drying process.

On prints that have been treated with emulsion hardener, it is necessary not only to remove the emulsion, but the film itself must be scraped, so as to remove the hardener. The non-emulsion side should also be scraped.

Color film should be scraped on both sides.

FILM-WELD not being a cement but a bonding agent, it is absolutely necessary to remove any foreign matter so that the two films themselves are brought into contact.

If these directions are followed, a permanent bond will result.

LARRY STRONG, INC.

1241 So. Wabash Ave., Chicago, Ill.

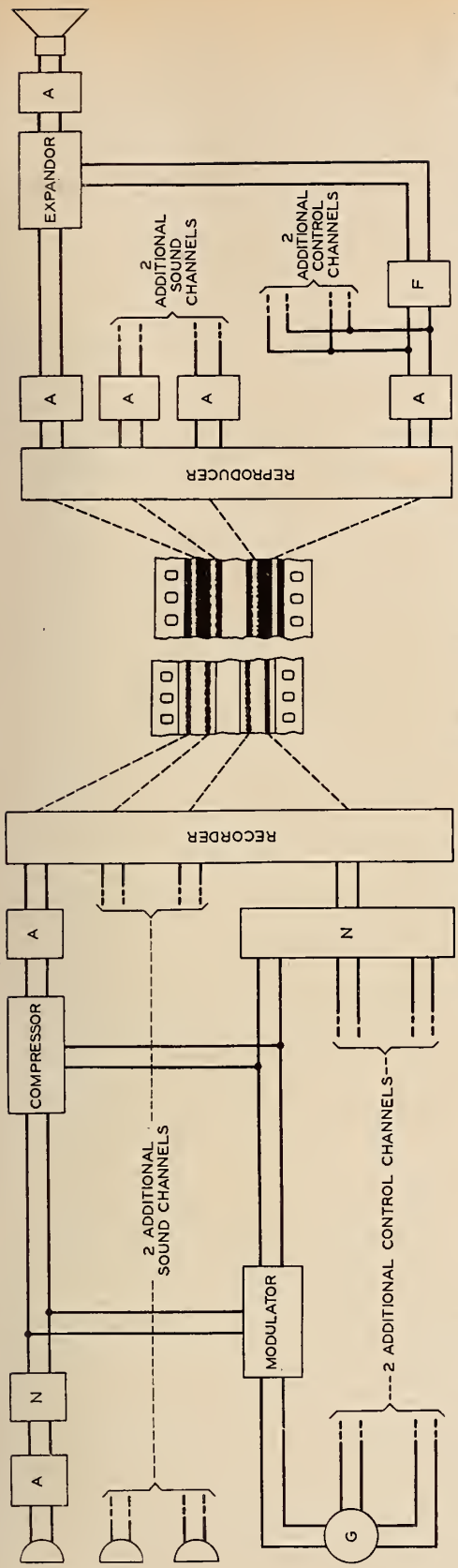


FIGURE 2 *Block schematic of the stereophonic sound system*

creased volume range. The maximum volume range that can be placed on a film is less than 50 db, while the stereophonic system, with a 10-db increase and decrease provided by the enhancement control, requires a range of 100 db. At the very outset, therefore, the recording of music for stereophonic reproduction seems faced with an insuperable obstacle.

The seemingly impossible task of recording a program having a volume range of 100 db on a film that will receive only a 50-db range was accomplished by use of compression and expansion devices performing functions similar to those used on certain transoceanic radio channels. The music as it is picked up by the microphones is passed through a compressor, one being provided for each channel. These allow the music currents to pass to the film-recording equipment in their normal volume range up to about 45 db; higher volumes are reduced by the compressor so that the limit of the film recording is not overstepped. At the same time a record is made on another track on the film of just the time and extent of these reductions.

At the reproducing end the music currents generated in photoelectric cells from a light beam passing through the film are carried through an expander before reaching the loudspeaker. The action of the expandor is controlled by the signal obtained from the additional light track. At any point where the original program was reduced in volume by the compressor, this signal will cause the expandor to increase the volume by just the right amount. In this way the full 100-db range in volume is reproduced by the loudspeakers without exceeding the 50-db range that is available on the film.

● Main System Elements

The main elements of the system are indicated on the block diagram shown as Fig. 2. To control the compressor at the recording end, a small amount of the program current is taken from the circuit just ahead of the compressor and is rectified. This rectified current modulates a single-frequency current, which then controls the compressor and also forms the signal placed on the fourth track on the film.

Since there are three channels, and the amount and time of compression will vary from one to another, three control signals must be recorded on the film, one for each of the three channels. These are all recorded on the same track on the film by allowing the three rectified currents to vary independently the strength of three alternating currents of different frequencies. These three modulated currents control their respective compressors and are then combined and recorded as the fourth track on the film.

After the film has been made, it is reproduced while the original conductor listens and manipulates the enhancement controls to modify the frequency and volume ranges of the three channels to secure an effect that more nearly conforms to his interpretation. The enhancement control unit is a unique unit. At the top are six keys used to control the frequency composition—there is one for each channel for adjusting the high frequencies, and one for each channel for the low frequencies. Each key has three positions and gives the control indicated by Fig. 3.

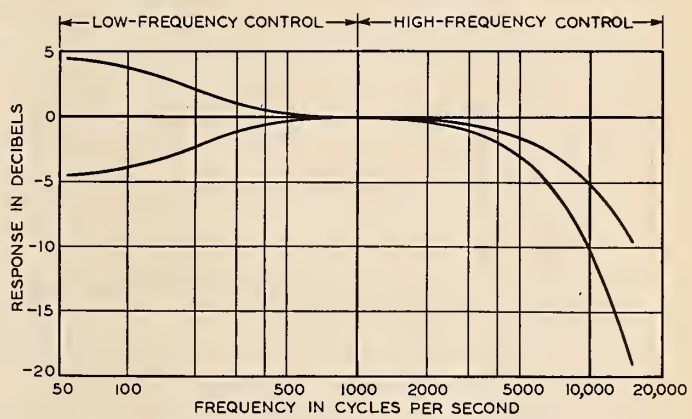


FIGURE 3 *Frequency characteristics obtainable by manipulating the six keys located on the top of the enhancement control unit*

The three handles on the front of the control unit are for adjusting the volumes of the three channels. As the handles are moved up from the normal position, the volume is increased, and as they are moved down, the volume is decreased. As the conductor listens to the reproduction of the original recording, he manipulates these controls, and another film is made of the enhanced program.

A block schematic for this phase of the operation is shown in Fig. 4

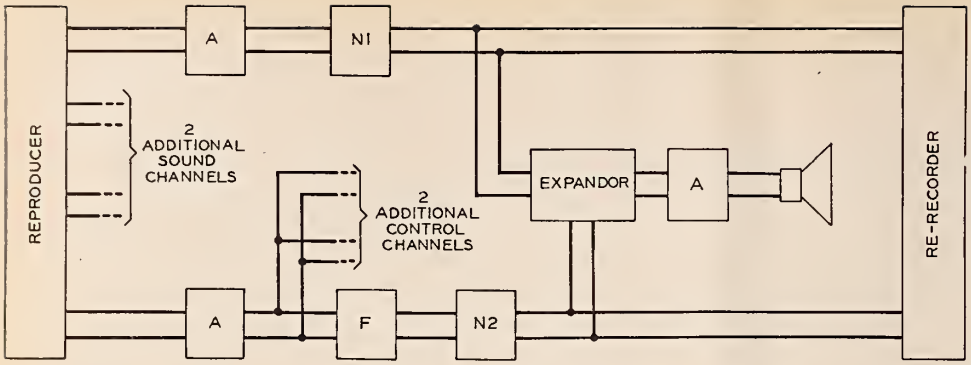


FIGURE 4. *Block schematic of circuit used for enhancing and re-recording*

which shows only one channel, however. The changes in frequency composition brought about by the enhancement control are secured by the insertion or removal of electrical filters in the circuit for each channel, marked N1 in Fig. 5. The volume control modifies the current of the auxiliary channel, which is used to control the action of the expandors. Both networks, N1 and N2, are inserted in the circuit ahead of the point where the monitoring circuit is taken off, and thus modify the program as heard by the conductor as well as the currents used for making the new film.

● Modified Track Results

On the new film, the three program sound tracks are the same as on the original film except for the frequency modifications brought about by the filters. The control track, however, has been modified by the manipulation of the enhancement control so as to cause greater or less expansion when the program is subsequently reproduced. The new film made as a result of this process thus represents the enhanced program, and is the one used for all subsequent reproductions.

● Much Incidental Development

Besides the compressors, expandors, and filters required for this new system, there has been a considerable amount of incidental development of the associated parts. There had to be provided, for example, a carefully designed source for the three signal frequencies used to control the expandors, and narrow band-pass filters had to be provided to separate the three frequencies at the reproducer so that each would control its own expandor.

Other developments were required to secure accurate timing. The signals must cause the expandors to act at exactly the same point on the film that the compressors had acted during the original recording. In addition practically every piece of equipment had to be studied and partly redesigned to reduce sources of noise and distortion that in other circumstances would be unobjectionable.

A Common Cause of Condenser Failure

HAVE you ever noticed that condenser failures in modern sound system amplifiers often occur when the amplifier is first turned on, before the start of the show? This applies to condensers in preliminary stages which are subjected to plate potentials.

For inquiring minds, Altec Service Corp. dispels the question mark by giving the following interesting explanation for this condition which often appears to be a matter of coincidence but usually is not.

Amplifiers today generally employ a rectifier tube having a directly-heated cathode (filament), whereas most of the remaining tubes have indirectly-heated cathodes. When the amplifier is first turned on the directly-heated cathode of the rectifier becomes hot and the rectifier starts passing current and builds up a potential in the filter bank almost immediately.

The indirectly-heated cathode tubes, which provide much of the load on the plate supply require 10 or 20 seconds to become hot enough to emit electrons and support a plate current flow. During this short interval while the indirectly-heated cathodes are still warming up, these tubes provide no load, and the condensers in their plate circuits are subjected to a potential far in excess of normal operating potential.

● Abnormal Start Current

Measurements show that during the warming-up interval the potential applied to certain condensers of a typical widely used amplifier is three times normal. As soon as the indirectly-heated cathodes become hot enough to support a normal plate current flow, the normal loads of these tubes become effective and potentials in their plate circuits drop to normal volume.

FILM INDUSTRY STATISTICS

Financial worth of the American motion picture industry is conservatively estimated as in excess of two billion dollars, according to U. S. Dept. of Commerce. One hundred firms are engaged in producing motion pictures in the U. S., producing an annual average of 500 feature films and 800 "shorts," at an estimated aggregate cost of $165,000,000. California accounts for 95 per cent of the total production, the remaining 5 per cent being produced in New York.

Approximately 28,500 people in the United States are employed in motion picture production, with Hollywood's annual payroll amounting to about $129,000,000. Between 100 and 250 prints of each feature film are required for initial distribution in this country, and 276 separate industries, arts and professions are involved in the making of a single feature picture.

In the exhibition field, 241,000 people are employed in 17,000 theatres operating in the U. S. which have a seating capacity of 10,462,208. Average weekly attendance at these theatres approximates 85,000,000 persons who contribute more than one billion dollars in yearly revenues at the box office. Film rentals paid by these theatres to distributors average over $250,000,000 yearly. For newspaper and magazine advertising the motion picture industry spends over $77,000,000 annually domestically and an additional $33,000,000 in foreign countries.

U. S. produces 65 per cent of all motion pictures exhibited throughout the world, and approximately 35 per cent of total revenues received by American film producers for their productions is derived from foreign sources.

GoldE 'FLASH' CHANGEOVER

The GoldE "Flash" aperture-type changeover is now ready for distribution, offering both a two-year guarantee under specific operating current conditions at an extremely low price. The unit is simple to install, the motor housing being mounted on two screws at the back of the projector. A drop-shutter type leaf fits the aperture, operates smoothly and has a trigger for easy operation of a five-point pin.

Perfect balance solenoids operate with a minimum of noise, maximum speed and efficiency. A 10-day free trial under actual room conditions can be arranged through regular supply dealer. GoldE micro footswitches are standard equipment with the unit. Full details from supply dealers or direct to GoldE Mfg. Co. at 1214 W. Madison St., Chicago.

RCA INSTITUTES U.-H. F. BOOK

RCA Institutes Technical Press has just published a new book entitled "Radio at Ultra-High Frequencies," a 456-page volume relating to transmission, propagation and relaying, measurement, reception, and u.-h. frequencies above 33 mc. Book will not be sold but will be distributed exclusively as a premium for a third-year subscription, either new or renewal, to the *RCA Review*, published by the Institute at 75 Varick St., N. Y. City.

J. MORGAN AFL DELEGATE

J. O. Morgan, business representative of Local 507, Macon, Ga., has been named State delegate to the A. F. of L. Convention in New Orleans this fall. First I. A. man from Georgia to be so delegated.

Television, Projection Sessions Win Top Interest at S.M.P.E. Convention

TELEVISION emerged as the big noise of a rather well-balanced papers program at the Convention of the Society of Motion Picture Engineers at Atlantic City, April 22-25, judged on the basis of attendance at and absorbing interest displayed in the session devoted to this rapidly growing art. Five television papers, two of which entailed demonstrations, were presented, and although many of the motion picture people experienced extreme difficulty in grasping the data offered, there existed no diminution of interest through a rather long and tiring evening.

The Convention attracted about 200 registrations by engineers from all over the country, which figure tends to prove that really successful gatherings of the S.M.P.E. are possible only in New York, Hollywood or, possibly Chicago. Moreover, poor planning of the papers program was once again apparent, with delegates being asked to attend on successive days sessions which ran from 9 a.m. to well past midnight, with only brief breaks for luncheon and dinner, and the outright cancellation of the promised Wednesday afternoon holiday.

● Large Projection Group

Even the most ardent devotee of science can hardly bear up under such a program and still retain sufficient mental alertness to get much out of the sessions. Numerous unfavorable criticisms of such extended sessions were heard, and it is expected that a change for the better will be effected before the Fall Convention, which is scheduled for Hollywood.

The projection session again proved its popularity by netting an audience second only to the television program, and while no outstanding paper was offered thereat, the literature was enhanced by several worth while contributions. Wilmer & Vincent Theatres again demonstrated its progressivism by having as its guests at the Convention a group of projectionists from its string of theatres. In fact, it can be reported in passing that projection people, most of whom were "on their own" so far as expense is concerned, constituted well over 25 per cent of the total registration.

The get-together luncheon on the first day of the meeting was marked by a most interesting address by T. F. Joyce, vice-president of RCA Mfg. Co., entitled "The General Outlook for Television." Pleading for a closer tie-up between the motion picture and television industries, Mr. Joyce advanced the now familiar claim that television will help enormously in the merchandising of motion pictures in the same manner that radio broadcasting does now. [This has been a moot point since the inception of television, although the motion picture industry is practically unanimous in holding that radio hurts films tremendously. It's the old story bearing on the physical impossibility of a person (a customer, that is) being in two places, the home and the theatre, at the same time.]

Predicting that within a year after the F.C.C. okays grants commercial television programs more than 25,000 television receivers will be sold in the N. Y. area alone. Mr. Joyce said that television was a potentially gigantic industry that would eventually provide employment for hundreds of thousands of people. Approximately 30 stations in 18 cities have applied for television licenses, he added. Six of these have already been granted. If the others are granted, 8 to 10 million families, or about 25 per cent of our entire population, will be able to receive television service in the home.

● Million Receivers in 5 Years

"If these television stations do begin sending out television programs, I do not think that the prediction of at least a million television receivers being purchased by the American public within five years is too optimistic. That means that our potentially great television industry is fairly under way."

Mr. Joyce invited the motion picture industry to play a more important role in the early development of television as an entertainment service. He pointed out that no one has yet been able to gauge exactly the public's great capacity for entertainment. As work hours are shortened and people have more time for leisure, they will be receptive to new as well as long established forms of entertainment, and will patronize those which offer the best services, without necessarily hurting any existing forms of entertainment that continue to give the public the service it wants.

Mr. Joyce said that television would open up many new avenues of exploitation to the motion picture industry. By means of television, condensed previews of movies can be presented to home audiences. Potential screen stars will receive their screen tests through

(*Continued on page* 27)



Projection group at the recent S.M.P.E. Convention includes H. Blumberg, Nate Golden, F. Hohmeister, I. Jacobson, Marty Bennett, Jack Sawyer, Vic Welman, Larry Strong, Bobby Burns, J. Seeley, C. Treen, B. Blumberg, Herb Griffin, Jim Finn, H. Behr, H. Freeman, F. H. Richardson, Ray Gallo, Bill Kunzmann, Joe Basson, P. A. McGuire, T. Hover, S. Seifert, H. Braun, C. Bruuner, Joe Engle, and a flock of unidentified RCA, Altec and Wilmer & Vincent personages. W. Reed, first professional projectionist in the U. S., is seated in center of second row from bottom.

The Influence of Sound Accompaniment on the Dramatic Value of Pictures

AN infinite variety of sounds is encountered in nature. The ear distinguishes one from another because of slight variations in quality and intensity. It is important to note that intensity or loudness contributes as much to the identification and location of a sound as the quality. This is demonstrated by the fact that if the sound created by a fly walking across a thin. tightly-stretched diaphram is amplified by a high-gain amplifier and reproduced by a big speaker system, the ear might interpret what it hears as the beating of a bass drum.

The range of sound intensities found in nature is tremendous. The crashing of thunder produces more than ten billion times as much sound energy as the gentle rustling of the wind in the trees. Therefore, it can be seen that if we are to record and reproduce natural sounds faithfully and effectively, our equipment must be capable of reproducing accurately not only every minute change in quality but also the full range of volume levels that the ear can hear.

When sound accompaniment of motion pictures is natural and realistic, the dramatic value of the picture is enhanced considerably; but if the sound is harsh and unnatural, it becomes irritating and detracts from the value of the picture.

● Early Work Ineffective

Some of the early exhibitors of motion pictures recognized the effect good sound accompaniment can have on the audience. *The Great Train Robbery*. one of the first feature-length silent pictures, was shown in a tent as an attraction in a street carnival which toured the country. The picture was accompanied by very realistic sound effects, produced by a crew of men behind the screen.

In one scene, a bandit is shown in a close-up firing a pistol into the audience. This scene was made realistic by firing a real pistol behind the screen in proper synchronization with the picture. This action startled the audience just as much as if they had been actually fired at. The effectiveness of this scene depended on adequate volume or loudness of the sound and upon its realism.

The realism of early sound-on-film motion pictures fell far short of this original sound accompanied picture chiefly because the sound was far from natural both from the standpoint of quality and volume range.

Early development work stressed improvement of quality but did little with improvement of the recorded volume range. Quality of reproduction was improved primarily by extending the frequency range, reducing distortion in recording, printing, and processing, and improving film scanning systems for both recording and reproduction.

● Signal-to-Noise Ratio

The maximum volume range that can be recorded on film—that is, the range from the faintest to the loudest sound that can be reproduced—is limited to the volume range between the surface noise and the level produced by a sound track modulated 100 per cent.

Until recent years, general recording practice has been to maintain the modulation on all recording as close to 100 per cent as possible to obtain the best signal-to-noise ratio. While this procedure accomplished the desired purpose, it detracts materially from the naturalness because all sounds, whether a whisper or a shout, a single musical instrument or a brass band, a pistol report or the roar of cannon, were reproduced at approximately the same level.

The fact that early sound reproducing systems had very limited power output, also made it necessary to record all sounds at approximately the same level. This meant that the reproducing system was putting out almost maximum power at all times, so that no reserve power was available to reproduce dramatic effects even if they had been recorded on the film.

The introduction of ground noise reduction systems in recording, the improvement of film stock, and the improvement of re-recording and processing methods all have reduced the residual background noise in the sound track to the point where it is now possible to record and reproduce relatively low level signals with a satisfactory signal-to-noise ratio.

Equipment manufacturers have cooperated by designing sound reproducing equipment with ample reserve power, so that highly dramatic effects can be reproduced at the proper level without distortion; they have reduced the inherent noise level of the amplifiers so that low level signals can be reproduced without annoying hum or hiss from the theatre system.

The combination of these improvements has now made it possible to satisfactorily record and reproduce a volume range of about 50 decibels with standard soundtrack. This means that the loudest sound reproduced represents approximately 100,000 times as much sound energy as the faintest sound satisfactorily reproduced. The useful volume range on push-pull recording is generally greater than this because of lower inherent noise level in the soundtrack. While this volume range still falls short of the range found in nature, it is adequate to reproduce a large percentage of all sounds at their proper respective levels

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Double Features Kill Shorts, Film Showmen Assert

The sharp reduction in the number of short films during the season now closing is interpreted by showmen as the beginning of the end for this type of release, excepting for cartoons. Three reasons are advanced for the expected demise of short reels: the rapid spread of double features, greater footage of both A and B releases, and the constant harassment of distributors on the point of "forcing" purchase of shorts.

Practically the entire country is now playing duals, except for a few zones in the South and West. Latter are expected to be forced to adopt doubles within a short time. Exhibs will rely upon newsreels, cartoons, and fashion singles in future to sandwich between features.

KILL DUALS, ASK W. C. EXHIBS.

Independent exhibitors of Alaska, Washington and Northern Idaho, okayed a resolution condemning double bills. Duals were branded as an "objectionable, unbelievable and harmful practice."

Long programs were said to be too tiring on mind and body, curtailed juvenile attendance and that double bills at a low price are bad merchandising; further that doubling of two good pictures lessens the value of each. A petition for a single bill which was signed by every independent in Seattle was killed when an affiliated circuit refused to sign.

and represents a tremendous improvement over the early limited recordings.

Major film studios first started taking advantage of this greater useful volume range in the latter part of 1937, when, through the cooperation of the Research Council of the Academy of M. P. Arts and Sciences, they introduced "Hi-Range" prints.

● Hi-Range Prints

In recording "Hi-Range" prints most of the dialogue passages are intentionally reduced in modulation so that average dialogue modulation rarely exceeds 50 per cent, while music and dramatic effects are recorded at 100 per cent modulation. This provides a volume difference between dialogue and music of at least six decibels. This is in direct contrast to "Regular" prints in which both dialogue and music are given 100 per cent modulation most of the time.

To reproduce a "Hi-Range" print satisfactorily the system gain control should be set so that dialogue will be reproduced at the proper volume, and left there. The special effects and music will then come in at the proper level for the greatest dramatic effect. The relative volume levels have been carefully pre-determined by experienced showmen and have been adjusted on the film during the re-recording process so that it relieves the projectionist of the necessity of "riding the gain" to get proper reproduction.

It is generally found that the fader setting for this type of print is about 6 db higher than for a standard print since the average modulation on dialogue is only half as great. It should also be remembered that these prints can only be properly reproduced with a modern sound system that has enough reserve power to allow the fader to be advanced 6 db without overloading the system on loud passages.

After listening to the early type recordings for several years, many exhibitors have become accustomed to hearing all sounds reproduced at the same level and now feel that modern recording should be shown the same way. In doing this all the naturalness and added color that recording engineers have worked so hard to produce is lost.

Several exhibitors objected to the loudness of the bells in the recent picture *Hunchback of Notre Dame* when a close-up of the huge bells in action was shown. Actually it was not possible to record a great enough volume range on the film to reproduce the sound of the bells at their true intensity. In the course of the picture, the hunchback stated that the large bell made him deaf. Surely no theatre sound system has yet approached this intensity.

● Projectionist Aid Vital

It is, therefore, directly up to the projectionist, who in reality is responsible for the proper presentation of a program, to point out to the exhibitor the vital importance of this wide volume range for natural and effective sound. The dramatic value of pictures shown will be reflected directly in box office receipts—an indisputed fact.

One further point on correct volume level that is quite often overlooked is that the frequency response characteristic of the human ear changes for different sound levels. When the response of a sound system is adjusted for proper balance between high frequencies and low frequencies at a certain optimum sound level in the auditorium, pictures reproduced at this level are natural and pleasing. However, if the average level is increased or decreased, the sound quality changes completely and the sound is no longer balanced.

Generally, if the level is set too low, the sound loses "screen presence" and sounds as if the actors are far behind the screen. If the level is too high, certain imperfections in the voice such as excess sibilance are over-accentuated and the sound becomes irritating. Projectionists should carefully determine the average gain setting for their theatre which gives the most pleasing and understandable sound. In this way audiences will be assured of sound reproduction as originally conceived and planned at great expense by the producers.

G. T. E. FIRST QUARTER PROFIT

General Theatres Equipment Corp. and subsidiaries reported for the three months ended March 31, 1940, consolidated net profit of $212,681 after depreciation and estimated Federal income tax, subject to year-end adjustments. This is equivalent to 36 cents per share on 592,887 shares of common stock outstanding. It compares with $145,544 for the first quarter of 1939.

'GONE' BOOSTS LOEW NET

Earnings of Loew's Inc. for the 28 weeks ended March 14, after depreciation and taxes and reserves for contingencies, was $6,789,828, equivalent, after preferred dividends of $49.66 per share, to $3.79 per share on outstanding common. Comparable figures for the same period of 1939 were $6,368,847 in earnings, equal to $3.68 per share on the common. Sensational grosses of GWTW are undoubtedly reflected in current figures.

Current Television Developments

HIGHLIGHT of the month's developments was the pounding the F.C.C. took from legislators, newspapers, and rival television sponsors. The tussle between opposing interests finally dragged in President Roosevelt, who, in backing up the F.C.C., said that the government was anxious to prevent any party getting a "hammerlock" on the public and that sets sold now will be capable of picking up signals from any transmitter.

Results of the F.C.C.'s digging into television matters over a period of recent weeks is expected to be made public shortly, although informed quarters say that publication of the report does not presage early lifting of the bars against commercial television. Despite this pessimistic outlook RCA continued to expand its television program services, the while it sent its representatives into the hinterlands to beat the tocsin in favor of early commercialization of the art.

● No Frozen Standards

The intra-industry feud found RCA and the Dumont interests locked in what appears to be a knock-down, drag-out fight to the finish. Each slurs the other verbally on the score of technical standards, but it is believed that the real basis for the trouble lies deep below these surface indications and probably focuses upon financial and other tie-ups. RCA charged that Dumont was "obstructing" progress at the behest of Paramount Pictures, which owns a substantial interest in Dumont, to the end that Par might "protect its ledger interest" in the movie production and exhibition fields.

An answer to this charge was forthcoming immediately from Paul Raiborn, treasurer of Dumont and also a Paramount executive. He pointed out that the sole request of Dumont to the F.C.C. has been to maintain flexible standards instead of the rigid ones proposed by RCA and the Radio Manufacturers Association. Raiborn also accused RCA of deliberately avoiding admission in its report that the Dumont system gives a 625-line definition as against the RCA 441-line definition.

Raiborn further stated that impartial experts in the television field have agreed that line definition, so long as 15 or more frames are used, has more to do with the clarity of the image than the number of frames. RCA charged that 15 frames, now being used by Dumont, will give inferior images to the RCA 30 frames per second system.

● RCA Technical Advances

RCA replied that while it was unwilling to substitute Dumont's judgment on technical standards for its own, it was ready now to market a television unit that will receive trans-

(*Continued on page* 26)

Regeneration and Preservation of Film

By *Dr. ALFRED KALIX*

Numerous processes for the protection of nitro-cellulose film stock have been described during the past twenty years, the problem being attacked from two sides: either preservation or regeneration. Pre-treatment is the vogue today, with a print once released being left to wear itself out in service without any attention other than cleaning. The accompanying article is a brief review of some of the more popular processes, most of which have been extensively tested in Europe.

FROM the earliest days of the cinematography efforts have been made to eliminate scratches or "rain" on used films. Projectionists have used carbon tetrachloride or other non-inflammable solvents; such processes are not very thorough and have only a temporary effect.

The more satisfactory methods of film treatment are of two kinds: after-treatment of the already damaged film, and the preserving process, which treats both surfaces before the film is run, so that scratching on either side will be minimized. In the first place, scratches were removed mechanically, by brushing or polishing. Quite a number of processes and devices have been described.

In another method, which operates chemically, the celluloid side of the film is treated with a solvent, which is applied in a thin layer, for instance by spraying. Thus the sharp edges of the scratches are removed, and after the solvent has evaporated, the surface is no longer ridged. In order to fill in the grooves completely, the use of cellulose lacquer has recently been suggested, so providing an even surface. The film is run through a solution of nitro-cellulose or the like, and the surplus is squeegeed off.

● Preventive Processes Lead

More numerous are processes for preventive treatment, which mostly consist in applying a special layer to one or both sides of the film. Practically all materials known to form an emulsion have been tried. The oldest coating process was that used by Gaumont in 1908, employing a mixture of collodion and non-volatile oils. Subsequently gelatine, shellac, cellulose esters, wax, synthetic resins, *etc.*, have been used. These materials were as a rule applied as a solution, or suspended in water. Particular care must be taken to keep the sprocket holes open, such as by compressed air jets.

Finally, instead of applying solutions, thin foils have been cemented onto the film. Some experimenters have applied these protective foils on one or the other side; others on both sides; some applied the protective layer on the newly manufactured stock; others on the developed picture.

It is obvious that any protective layer serves its purpose only if it not only protects against scratching, but also adheres well to the film in spite of the wear and tear and high temperatures of the projector. If the layer were to peel off, the resulting particles which sometimes become glass-hard, would lodge in the gate and cause further damage to the film. In order to obtain perfect adhesion, care must be taken of the chemical composition of the substratum and its physical condition. Therefore a swelling of the emulsion preparatory to the application of the layer is necessary.

● Collodion Penetration

According to one patent specification†, the adhesion is improved because the colloid penetrates the emulsion right through to the support. Later workers have disputed this; nevertheless, it is a fact that a layer of collodion applied to gelatine swollen by glacial acetic adheres far better than without swelling.

Later on, the same inventor used ethylene-chloridine as the swelling medium for both sides of the film. This process can be simplified by mixing the swelling medium with the coating material.

Recent investigations have shown that nitro-cellulose, which is mostly used, is less resistant to scratching than gelatine. Thus it seems to be contrary to sense to protect gelatine by collodion. There are, however, optical reasons for the use of collodion; on the other hand, emulsion technique has made considerable progress, and gelatine is again recommended as a protective medium.

It is not applied as a coating, but the actual gelatine of the emulsion is used by superficially hardening it. This process does not harden the whole emulsion throughout, as previously suggested, which affects the elasticity. The new process not only avoids this, but also removes the surface fog.

The developed film is simply squeegeed, and run through an oxidizing bath without washing. Oxidizing is effected by well-known reducing solutions; the picture is not affected, as the emulsion is soaked with developer which prevents the reducer penetrating it. At the same time, this reaction hardens the surface of the gelatine. The optical improvement consists not only in removing the surface fog, but also in avoiding an additional refracting surface.

†The original article in *Kinotechnik* for Nov. 1939 contains numerous patent references.

GOODMAN HEADS LIST OF RCA SERVICE PROMOTIONS

Appointment of Adolph Goodman as assistant manager of the RCA Service Division heads a list of advancements announced recently by Service Manager W. L. Jones. Goodman's new duties entail direction of all Photophone service activities, and in addition he will continue an active interest in Photophone service technical development which he has supervised for several years.

Carl Johnson, Kansas City manager, has been transferred to the Camden office. Bill Hardman, formerly of the Camden staff, assumes the K. C. post.

N. A. Willis, field engineer in Baltimore and Adolf Lof, of New York, have won promotions similar to Mr. Johnson's. F. M. Armstrong replaces Willis, while A. P. Wark, night emergency man at New York, succeeds Lof, and M. Gibbons assumes Wark's old position.

INDIVIDUAL SPEAKER PER CAR IN NEW OUTDOOR PLANTS

Newest sound projection wrinkle in outdoor motor theatres is individual speakers for each car, providing soft tonal quality and practically eliminating distortion. This system will be used in Milwaukee's first Drive-In theatre now open. Fifteen-acre lot containing 11 semicircular ramps will accommodate 500 cars. Screen building towers 100 feet into the air and picture sheet measures 50 by 60 feet.

Projection is sufficiently powerful so visibility will not be affected by ordinary rainstorm. Plant represents $75,000 investment.

MOTIO. CENTRAL DISTRIBUTORS

Indiana Theatre Equip. Co., 316 N. Illinois St., Indianapolis, in association with Central Theatre Supply Co., 318 Fifth Ave., Louisville, will be exclusive distributors of Motiograph projection and sound equipment in the Indiana-Kentucky territory.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

CERTAIN mercury-vapor rectifier tubes must be preheated before putting them into service. The tube is preheated by lighting the filament for a specified length of time and not applying a plate voltage during this time. During the preheating period any mercury which has collected on the filament or heater is vaporized, after which a voltage may be applied to the plate of the tube without danger of arcing between the elements.

Spare tubes can be preheated at any time and thus conditioned for immediate use; however, they must be kept in an upright position and handled carefully so that mercury globules will not be deposited on the filament or heater prior to its being used.

Ralph Slagle, projectionist at the Palace Theatre, Marion, Ohio, puts his preheated spare in a glass tumbler located in the bottom of the amplifier rack. Such a mounting is fairly sturdy and holds the tube in an upright position. Other projectionists have rigged up various types of metal brackets for this same purpose.—H. J. BENHAM, R.C.A., *Cleveland, Ohio.*

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Who hasn't been baffled by the problem of protecting vital sound reproducer parts from oil leaking from aged projector heads? Oil shields are now installed most everywhere, and a good job they do, too, except for that unshielded area surrounding the film path.

Here is a stunt which, although somewhat haywire, is unquestionably effective in protecting against oil dripping through the film path opening in the oil shield. He determines the part in the projector head from which the oil is dripping, usually a stripper or something similar. To the lowest point of this part is attached an "oil drain wire" which is bent so that oil collecting at the lower extremity of the part will creep down the wire and then be dropped onto the shield. It isn't a bad idea to try when economics preclude fundamental correction.—P. S. CASE, *Altec, Newark, N. J.*

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C. Harry Taylor, RCA's Baltimore District Service Manager, says: "One of the simplest ways of giving the stage loudspeakers a quick check before the show, is to raise the volume control setting and listen for the phototube hiss as reproduced through the high-frequency loudspeakers. Then bring an a.c. lamp within range of the phototube and listen for the 120-cycle hum reproduced by the low-frequency loudspeakers.

"These two tests require only a few minutes and give a fairly good indication whether the stage speakers are operating okay".

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The idea of using a dental mirror for getting around corners to examine inaccessible parts of a sound reproducer is not new, as many service inspectors and projectionists have used this scheme for years. Here is a refinement which multiplies the convenience and effectiveness of this tool:

The tool consists of a fountain pen type flashlight having attached to it a dental mirror. The mirror is fastened to the barrel of the flashlight by means of two metal clips soldered to the barrel. This method of mounting allows the mirror to be easily removed from the flashlight barrel whenever necessary.

The advantage of using this tool comes in checking sprocket wear, gear mesh and wear, and alignment of pad rollers. The light shines directly on the mirror and the sound track, or whatever is being checked, and can be closely observed by looking for the reflection in the mirror.—F. H. RIFFLE, *Altec, Kentucky.*

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A recent trouble call revealed a defective condenser in the monitor amplifier. The condenser had been subjected to heat generated by a spot light which was located directly under the amplifier.

Moral: Keep all heat generating units away from electrical equipment. An increase in the surrounding or ambient temperature will effect seriously the safety factor designed into condensers, resistors and transformers. It is because these units are so allergic to heat that amplifier failures always run much higher in the summer time than in the winter time.—B. B. COLEMAN, *Altec, Penna.*

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For that spot where you can just get one finger in to hold a unit, wrap a piece of scotch tape around the finger that fits the spot and double the tape back so the adhesive side is out. Press the nut on the adhesive and you're all set.—R. S. SEARS, R.C.A., *Pittsburgh.*

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A few years back, a number of 2000-foot aluminum reels were made with castings, and in many cases loosened up after a few years of service. When these hubs become loose, the reel is practically useless. This can be easily repaired by drilling and tapping a hole through the aluminum part of the hub, and inserting an Allen set screw to tighten down on the loose hub. The bronze hub should be left in place while drilling the hole in the aluminum part of the hub, so as to spot it with the drill. The set screw holds better with this mark on the hub. The bronze hub should be pounded out while the hub is being tapped.

This hole should be drilled at a slight angle so that there will be sufficient clearance for the tap wrench when the hole is tapped. The aluminum casting is about ¼" thick at this point, and if a ¼" Allen set screw is used, the result is a nice smooth job with no burrs. You have to look twice to see that anything has been done to the reel.

Also, I discovered a solution that is better than anything I ever heard of for removing film scum from heads scorched by fire. It is merely a 50-50 mixture of denatured alcohol and hot water. It requires no time to dissolve, but goes to work right away.—J. A. DOYLE, R.C.A., *San Francisco.*

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Here is a quick and accurate way of balancing machine outputs of Simplex A, B and C systems: Machine outputs can be balanced rapidly (with frequency responses within limits) by using a.c. supply to exciters and plugging volume indicator in headphone jack, stage horns off. Cathode resistors in each amplifier can then be adjusted for proper level.—F. J. PFEIFF, *Altec, Boston.*

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While running routine tests with oscillograph and oscillator at a theatre early one Sunday morning, we were rudely interrupted by police who had surrounded the theatre, while a sergeant with drawn gun cornered us in the projection room.

We learned that the howl of the oscil-

lator coming from the speakers could be heard outside the building and it sounded like the screech of a drill on the theatre safe. When explanations had been completed, it was hard to tell if the policemen were quite relieved or slightly disappointed.—M. E. WHEATON, R.C.A., *Boston.*

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At times you will find an exciter lamp in which the filament is not exactly centered, and the image projected through the lens system onto a white card will be yellow or dark on one side. By turning the lamp 180 degrees in the socket satisfactory focus can usually be made.—H. FRED PITZER, R.C.A., *Kansas City, Mo.*

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Surgical swabs made by wrapping absorbent cotton around one end of a toothpick are ideal for cleaning lens systems. They are inexpensive and will not damage the lens surface.—FRED HUFF, R.C.A., *New Jersey.*

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Always use a copper wire to remove dirt from a soundhead or projector. Copper will not scratch or produce burrs on the harder machine parts, while wire of other material may.—R. S. SEAR, R.C.A., *Pittsburgh.*

SEVERAL trouble calls usually come in every month reporting low volume and distorted reproduction which are traced to an exciter lamp not being properly adjusted. All of which form the basis for a few cautioning remarks about this vital adjustment which is too often considered a minor routine.

Here are the two most common troubles that occur when excited lamp adjustment is not optimum:

1. If the lateral adjustment is such that the scanning beam does not illuminate the entire width of the sound track uniformly, distortion will positively occur when reproducing variable area sound tracks, since the peaks of the recording will be cut off, and on variable density sound tracks, the volume will not be a maximum.

2. Poor vertical adjustment, also the use of exciter lamps with crooked filaments, often will cause noise. The filament of an exciter lamp always vibrates to a certain extent, and if its vertical adjustment is such that a non-uniform portion of its image rests on the edge of the lens tube slit, minute vibration will cause modulation of the slit illumination and consequent "microphonic" noise in the sound reproduction.—J. H. PESEK, *Altec, Chicago.*

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Any good grade of lacquer thinner proves much more effective than peroxide in removing smoke film from fire-damaged parts. Lacquer thinner is highly inflammable—so be careful. Let's have more suggestions on methods of cleaning fire damaged equipment. Anyone who has experienced a fire will appreciate them.—B. D. DOUGLASS, R.C.A., *Kansas City, Mo.*

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Aid was solicited in locating a high-pitched whistle which was apparently coming from the sound system. In the projection room the whistle was about 6 db above the noise level and seemed to be coming from all directions. A "hot" bearing was my first deduction, but this had been the projectionist's theory, too, and all bearings had been checked and found perfectly normal. The changeover to the second machine definitely eliminated the hot-bearing theory.

The main amplifier switch was then pulled, but the whistle still persisted. Feeling thirsty, I touched the water faucet—and the mystery was solved. A slow stream of water passing the water valve was the source of the trouble.—N. D. OWENS, R.C.A., *Long Beach, Calif.*

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An emergency call was occasioned by breakage of the glass tube of the mercury switch which operated one of the projector motors. This condition did not hold up the show, however—the projectionist had short-circuited the defective switch and was stopping and starting the motor by removing and inserting one of the power fuses. —F. H. JENNINGS, *Altec, Boston.*

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There is nothing that will cause more gray hairs in a service inspector's head and cause theatre managers to get caustic than the intermittent type of trouble which comes into the sound system, or which, when it does come in, doesn't last long enough to trace its cause. Clearance of this type of trouble depends largely upon the ingenuity of the projectionist and the serviceman.

We recently had a case of intermittent trouble which appeared to be due to a coupling condenser; however, as the trouble would not occur while the inspector was in the theatre, we had no definite proof of this. Finally the trouble reappeared when the inspector was in the house, but it only lasted for twenty seconds.

Hoping that the trouble would soon reappear, the inspector made preparations for instantaneous check. He connected a pair of test prods to a known good condenser. The trouble did reappear and with the test hook-up he was able to temporarily connect the good condenser in place of every coupling condenser in the amplifier in about fifteen seconds. By this procedure he definitely located the defective condenser and permanently cleared the trouble.—D. L. TURNER, *Altec, New York.*

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An old piece of weather-beaten awning or canvas does a swell job of cleaning commutators.

Projected light ray reflection from small objective parts is harmful to your eyes, and a portion of the diverging side rays which reflect on certain balcony ceilings or supports when large objective ports are used are objectionable to balcony patrons. Both of these conditions can be corrected very easily and inexpensively.

Place a piece of cardboard, port hole size, in your objective port and, without film in projector, project normal light on cardboard. Make a rough outline of light circle, then cut out portion where light is to pass, allowing approximately 1 inch greater diameter than light image. Paint cardboard with a lampblack mix or an extra dull black lacquer. This will permit scattering light rays to be absorbed. Also, in the case of large ports, your projection room will be more private. If your first piece of cardboard warps, try a heavier grade of semi-porous hoard.—JIM WARE, R.C.A., *West Virginia.*

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For trouble-free sound system operation it is most essential that every piece of electrical equipment in the projection room be kept in good operating condition. One never knows when a piece of run-down equipment, entirely dissociated from the sound system, will cause the sound system to "act up."

The wide variety of such things which can affect sound reproduction is illustrated by the following samples garnered from last month's emergency calls answered by Altec Service Corp.

Inspector H. E. Fetig, New York City, found a complaint of noise and motorboating in the sound system to be due to the lamphouse exhaust fan motor which had a defective and arcing commutator.

Inspector G. B. Brown, of Chicago, found that a bad hum reported on the No. 1 machine was due to a defective electric heater which was plugged into the base outlet on No. 2 machine.

Answering an emergency call, Inspector D. A. Swanagan, also of Chicago, found that the reason that the main power amplifier repeatedly blew fuses was due to the use of fuses of insufficient capacity.

Inspector P. S. Case, of Newark, N. J., in answering a noise trouble call, traced the trouble to a fluorescent tubular lamp.

Inspector M. Berger, of New York City, had to answer a trouble call because the theatre was unable to determine the location of the fusing of the main power circuit, which had blown.

Inspector S. Welsh, of Chicago, in answer to a reported "Roar in sound," rushed to the theatre where he found the trouble due to a short-circuit between the brushholder and frame of the Peerless arc lamp feed motor.

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In many projection rooms a short strip of film above each projector is used as a fuse link in the porthole fire shutters. This piece of film frequently becomes dried out and breaks, causing an interruption of the program. Suggest that such arrangements be replaced with a short strip of film rolled to form a tube, and this tube be used as a fuse link. Several layers of film rolled in this manner will withstand a considerable strain. Such an arrangement was recently used in the Rex Theatre, Minden, Louisiana, when standard fuse links were not available and the single strip of film would not support the weight. —R. H. STIMPERT, R.C.A., *Louisiana.*

N. T. S. PLANNING MANUAL

A manual on Projection Room Planning and equipment, incorporating the most advanced thought of ranking projection men, architects and equipment manufacturers, is being distributed by National Theatre Supply Co. branches. Several sample room layouts, applicable to all classes of theatres, are included.

POT CALLS THE KETTLE BLACK

It was to laugh when certain engineers at the recent SMPE Convention were outspokenly critical of television image definition. This from an industry that tolerates the greatest collection of junk shops in the form of alleged projection rooms ever assembled by a business. Not to mention extreme variations in print density in the same release, plus the horde of theatres still using low-intensity projection.

470 DIFFERENT RADIO TUBES

Did you know that there are no less than 470 different radio receiving type tubes on the market today, and that approximately 90 of these tube types account for 90% of the entire volume of tube business? 36 of these 90 tube types will actually cover every requirement for any type of receiving set circuit—including a.c. sets, a.c.-d.c. sets, battery, and auto sets. RCA has a program under way to encourage the use of these 36 types of tubes and thus improve the stability of the tube market. Such a movement will benefit all connected with the radio industry—including the customer.

POTENTIAL L.A. TELE MARKET

It was estimated that there are between 300 and 400 television sets in use in the Los Angeles area at the present time, but the belief is expressed that with full commercialization, approximately 10,000 sets could be sold in a reasonable length of time.

MICHIGAN FILM ITINERANTS

Up-state Michigan will be almost literally over-run with film exhibitor itinerants this summer. Approximately 20 companies will be in the field, operating from one to five circuits. Latter will include a minimum of five towns, indicating a total of 250 towns will be covered. Nearly all are theatreless; exceptions have houses open only one or two nights a week.

In the majority of cases 16 mm. will be used.

Kallet Theatres, Inc., has renewed Altec service agreements for the 16 Kallet theatres in N. Y. State.

ANNUAL FILM PAYROLL

Total annual payroll of the U. S. film industry approximates $369,000,000, shared by about 300,000 workers, Will H. Hays, MPPDA prexy, said recently.

Exhibition field, according to MPPDA figures, is the major factor from both the employment and payroll standpoint. Of the 300,000 workers, 255,000 are engaged in exhibition, earning annually $250,000,000. Production's 32,000 receive yearly an aggregate of $129,000,000, while distribution's 13,000 earn a total of $27,560,000.

Hays said that its two billion capital investment represented $1,880,000,000 in theatres, $100,000,000 in studios and $20,000,000 in distribution facilities.

20TH-FOX REDUCES PRINTS

Sidney R. Kent in a Government equity suit pre-trial examination, stated that film companies would have to cut down on prints if they did not wish to suffer increased loss. The 20th-Fox prexy said that the number of prints had been increased because of the insistence of distributors for a greater number of simultaneous runs



This "Partnership" Has a Single Purpose

In theatres throughout the country, projectionists and Altec inspectors work together in a "partnership" that goes way beyond a routine business contact. They have found a friendly, mutually helpful basis for working together, because they know their objectives are the same: to give the patrons the finest quality of entertainment that the equipment can produce. They are a "swell team in any man's theatre."

ALTEC
SERVICE CORPORATION

250 West 57th Street · New York City

THE SERVICE ORGANIZATION OF THE MOTION PICTURE INDUSTRY

FREEDOM OF ACTION

Separate POSITIVE Feed Mechanism

Separate NEGATIVE Feed Mechanism

MANUAL FEED DOES NOT INTERFERE WITH ELECTRICAL CONTROLS

Accurate, independent adjustment of either carbon without affecting the feeding speed of the other. This keeps the arc in exact focus with the optical system at all times.

RESERVE POWER
30 to 65 AMPERES

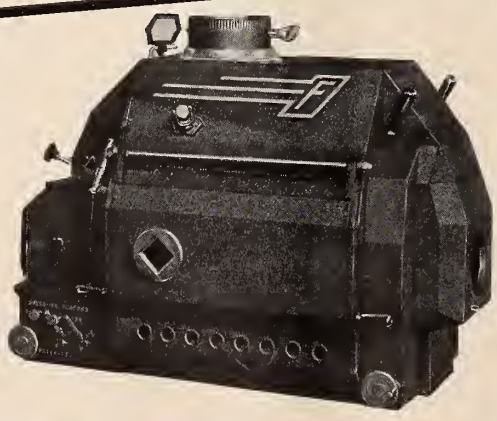
Regardless of the arc intensity used, 'just step it up' if a little more amperage is needed. You are not limited to a 40-ampere maximum.

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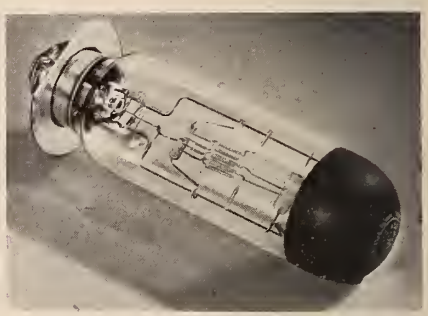
and that companies would pay for this weakness.

Kent stated that he had recently reduced the number of Fox prints. He added that the average print cost $140 and those in Technicolor, four times that much.

NEW B. & H. 750-WATT, 10-HOUR 16MM. PROJECTION LAMP

A new 750-watt, 10-hour lamp has just been announced by Bell & Howell. Claimed that this new unit produces 50% more light than the standard 750-watt, 25-hour lamp. Although the minimum life expectancy of the new lamp is but 10 hours, it is felt that this reduction is far outweighed in importance by the added brilliancy. B. & H. emphasizes that the new lamp does not replace the standard 750-watt, 25-hour lamp.

The new lamp will be furnished in the new "black-top" type, which eliminates the use of metal lamp caps; also with the well-known pre-focusing and pre-aligning ring on the base. In 1930, 250 watts represented peak illumination; whereas today sees the 750-watt lamp standard in the 16 mm. home projector, and, highest in the incandescent field, the 1200-watt lamp in the Filmo "Auditorium" projector.



New B. & H. 750-Watt Lamp

LOWER NEWS SOUND LEVEL

Pathe News has eliminated the high volume level of its reels in order to equalize the sound with that of the features. Present sound level of newsreels dates back to the advent of sound when the higher pitch was adopted in order to give emphasis. It is believed that the lower level will give a better over-all show. RKO is notifying theatres that their projectionists will not have to adjust the volume control when Pathe News is projected.

TELEVISION DEVELOPMENTS

(*Continued from page* 21)

mission of all types okayed by the F.C.C.

On the technical side the month witnessed an impressive demonstration by RCA at its stockholders meeting of a tele image 4½ by 6 feet, which size, President David Sarnoff announced, will be expanded to 9 by 12 feet within two months time. Sarnoff stated that the system will then be completely ready for theatre use.

Smaller system demonstrated evidenced a great advance in technique, except for the lighting. Unit used was built at a cost of $12,500 as an intermediate step in the development of apparatus for the projection of much larger images, but it has already become apparent that the 4¼ by 6 foot image has possibilities for use in

clubs, schools and other places where the viewing group numbers from 100-150.

RCA, however, has no immediate plans for marketing this apparatus. From 12 to 18 months would be required for its commercial development.

Apparatus used in the demonstration consists of three parts. One contains the newly developed kinescope projection tube and the optical system. Another contains the high voltage power supply, and the third houses the electric circuits, amplifiers and controls. All three are assembled on a single mobile platform. Overall dimensions are: length, 6 feet; width, 2 feet, and height, 5½ feet.

The new system is based on projection optics of extremely wide aperture, a kinescope capable of high voltage operation, and apparatus suited to these conditions. Most essential elements are the new kinescope projection tube and the optical system. These provide more light and utilize it more effectively than ever before, so that large screen tele becomes practical.

DON LEE READY FOR COAST THEATRE TELE PROGRAMS

First concrete plan readied by any television broadcaster to put programs into theatres is revealed in a brief filed by the Don Lee Broadcasting System with the F.C.C. in which it is stated that the Coast network has made a tentative agreement with a group of Coast exhibs. to reproduce television programs in theatres. At the same time, the brief made a plea for full commercialization and ending of hampering restrictions.

It was also stated in the brief that three or four advertisers have indicated they are ready to use the Lee television station, and that these programs would provide a means to determine the wants of advertisers and public reaction.

Joint Theatre-Home Reception

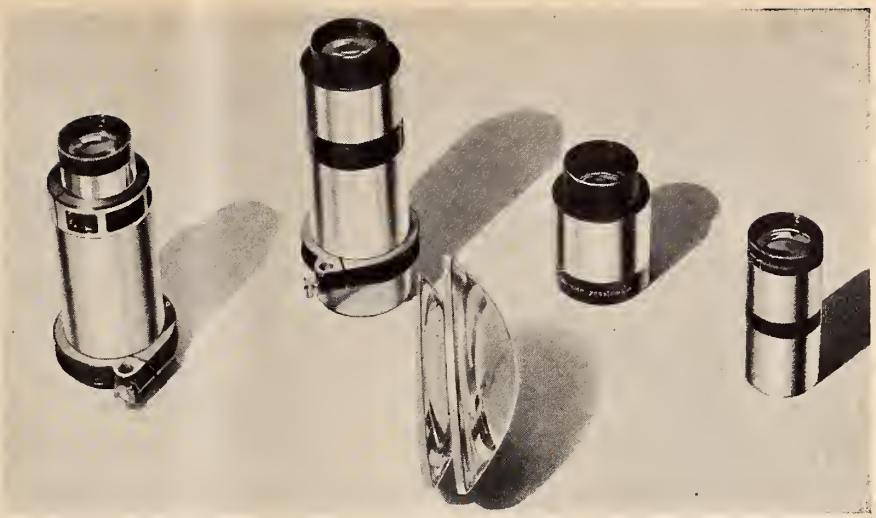
The brief estimates that such an arrangement with theatres would permit program expenditures of $18,000 to $20,000 a week. It is stated that not only would these programs be available to people owning television receivers, but could be seen and heard by those in attendance in theatres. It is also asserted that this program expenditure would be available regardless of whether the public purchased television receivers; in other words, this expenditure would be made independent of the number of receiving sets in the hands of the public.

Television, Projection Win Top Interest at S. M. P. E. Meet

(*Continued from page* 19)

the television camera. A director will be able to judge how a scene will look to his potential audience by viewing it on a television screen as it actually is being performed on the studio lot at the same time that the cameras are grinding out film.

He told the engineers that many of the first-night audience of the "Gone With the Wind" movie were disappointed because they did not have an opportunity to see the stars who had come from Hollywood to attend the



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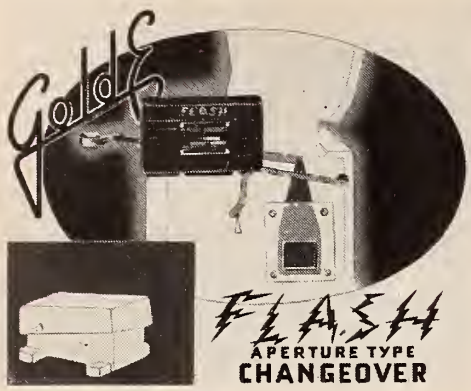
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premiere. Later it was learned that all the stars were attending a special party given by a prominent individual. With television many thousands might have attended this exclusive party while enjoying the comforts and conveniences of the home.

● Theatre Television Near

One took away from the Convention the very definite idea that at least one, and possibly two, of the television promoters are feverishly preparing for the advent of theatre television, with the present motion picture theatre being sold a service on much the same basis as sound pictures were merchandised. How long this situation will endure beyond the point where television sets are priced at a level attainable by a majority of the population, is anybody's guess.

Basing his conclusions of data obtained from 9,000 patients examined in 17 clinics in 12 cities, W. C. Beasley, of the National Institute of Health, U. S. Public Health Service, declared that only 5 per cent of all Americans sufficiently deafened to derive benefit through hearing aids actually use them. Hearing aids are used three times as often by women as by men because of different types of deafness which affect the two sexes.

Most women, Mr. Beasley found, have "conductive deafness," with a large amount of relatively uniform hearing loss of air-borne sounds, with practically no loss for sounds conducted through the bones of the skull. On the other hand, most men have "progressive nerve deafness," which involves large amounts of loss on tones above 1,000 cycles for both air and bone conduction, and very little loss by either air or bone conduction on tones below 500 cycles. Thus there is an intricate problem of relationship between the nature of hearing loss and the possibilities of improving hearing for the deafened through improvements in the design of hearing aids.

Moviegoers visit the film theatres to be entertained, and they enjoy themselves too much that the noise they make poses a problem for the industry, and audience noise level has been found to be a serious restriction to the volume range of motion picture dialog because it averages 8 db louder than the almost inaudible noise level of the sound reproducing equipment itself, according to W. A. Mueller, of Warner Bros. Studios. This represents almost 10 per cent of the audible range of the ear.

● Audience Noise Effect

"A series of noise measurements was made in theatres to determine the cause of low intelligibility of dialog recordings of wide range," Mr. Mueller said. "Audience noise is an extremely variable factor. Measurements made in the same theatre showed it to be as low as the film noise level in one instance, and later to rise to 14 decibels above this value. To secure good intelligibility of motion picture dialog, the volume range must be compressed so that the softest-spoken words never are so low as to be seriously masked by audience noise."

A plea for standardization of film splicing practices was made by W. H. Offenhauser, of the Berndt-Maurer Corp., N. Y. City. He discussed what is known in the industry as "blooping" sound film—that is, splicing ends of the film in such a manner that there is no interruption in the film sound, nor any audible noise when the patched portion of the film passes through the projector.

"Each motion picture producing organization has independently arrived at some rule-of-thumb solution to its particular problem, rather than any directed effort on the part of the whole industry," he said. "A wide variety of 'bloops' are in use, and a reduction in the number of sizes and types seems desirable in the interest of simplification." It was pointed out that there is almost complete agreement on the characteristics of the practice, and that standardization should be relatively simple.

C. C. Potwin, of ERPI told the Society: "Acoustic science can now be applied to better advantage than ever before in the planning of motion picture theatres," in his paper on "The Control of Sound In Theatres and Preview Rooms". "A broader understanding of the purposes and principles of acoustical design and treatment is needed, however, to make this application universal."

Mr. Potwin suggested that greater attention should be given to the design and development of the basic theatre structure. He said, "The all too prevalent idea that the more acoustical material used, the better results should be discouraged."

Research aiming to take the "guesswork" out of television camera technique, and thus assure more perfect reproduction of original scenes on home television receivers, is being carried on in the RCA research laboratories, Dr. I. G. Maloff told the Society. He indicated that because of the greater flexibility of the electrical signal as compared with photographic emulsions, lighting effects unobtainable at present in photography may be achieved in television.

"At present a skilled television cameraman can assure his audience a remarkably accurate reproduction of the original scene being televized because of his great experience and technical knowledge," Dr. Maloff explained. "We are attempting to de-

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velop an automatic system which will place less responsibility on the operator, at the same time, assure a better illusion of reality at the television receiver".

A new type of synchronizing waveform which keeps the television transmitter and all receivers tuned in to it operating together, makes possible automatic synchronizing of the receiver at variable line and frame frequencies, according to a technical paper presented by engineers of the DuMont Laboratories. The paper further points out that line and frame scanning frequencies need not be frozen to a standard giving limited definition peformance, since the synchronization system may be arranged to allow flexible operation.

● More Flexible Equipment

From two 10-ton trucks loaded down with bulky equipment, to a few suitcase sized containers that fit with ease into a station wagon, is the story of the development of new television pick-up equipment described by engineers of RCA and N.B.C.

Used to televise spot-news events, athletic contests, parades, *etc.*, the new light-weight equipment maintains the efficiency of its bulkier predecessor, while costing only a fraction as much, and having several times the flexibility. The engineers described each unit of the small system, including Inconoscope camera, controls, synchronizing generator, antenna, and a 325-megacycle relay transmitter and receiver. Each unit weighs from 40 to 70 pounds.

● Other Television Topics

The Television Session also heard the story of the televising of the Pasadena Rose Tournament Parade on last New Year's Day. Portable pick-up equipment relayed the television images nine miles to the Don Lee transmitter, where it was put on the air. Television viewers reported clear images, despite a darkly overcast sky and occasional rain. The sound portion of the television broadcast was heard coast-to-coast over the Mutual network.

Quality in television pictures was discussed by P. C. Goldmark and J. N. Dyer, of C.B.S. Factors that determine the appearance of a television picture, such as contrast, gradation, brilliance, and the shape of the scanning spot were discussed.

● The Projection Session

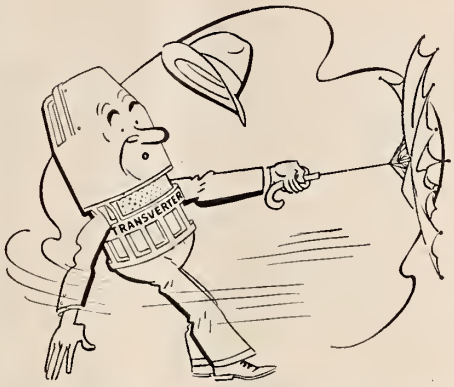
C. S. Ashcraft explained the new cyclex arc, which is based on a method of coordinating light impulses and projecting them through a rotating shutter to the screen. There is a total absence of the periodic visual beat which has heretofore characterized alternating current projection arcs, he said.

At the same time there has been developed a distinctly new type of A.C. arc which operates with a greatly reduced power input, producing several operating economies. Mr. Ashcraft also explained the technical points of a new type of power conversion equipment which has been devised to operate the new arc and light projection system.

That the motion picture industry feels an active concern for the proper projection of its films before the eyes of American moviegoers was demonstrated by the ten other technical papers on projection problems and their solutions.

I. Gordon, of Akron, Ohio, discussed the problem of oil left on film by projector mechanisms, and suggested means of overcoming it. The oil, he said,

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Only complete reels, as described below, are available (no short sections or single frequencies). The prices given include shipping charges to all points within the United States; shipping charges to other countries are additional.

35-Mm. Visual Film

Approximately 500 feet long, consisting of special targets with the aid of which travel-ghost, marginal and radial lens aberrations, definition, picture jump, and film weave may be detected and corrected.

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16-Mm. Sound-Film

Approximately 400 feet long, consisting of recordings of several speaking voices, piano, and orchestra; buzz-track; fixed frequencies for focusing sound optical system; fixed frequencies at constant level, for determining reproducer characteristics, frequency range, flutter, sound-track adjustment, 60- or 96-cycle modulation, etc.

The recorded frequency range of the voice and music extends to 6000 cps.; the constant-amplitude frequencies are in 11 steps from 50 cps. to 6000 cps.

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An optical reduction of the 35-mm. visual test-film, identical as to contents and approximately 400 feet long.

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SOCIETY OF MOTION PICTURE ENGINEERS

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spoils the moving image on the screen and tends to produce eye strain for the audience. T. P. Hover, of Lima, Ohio, closely associated with safety officials in Ohio, presented a paper on personal safety precautions for projectionists.

W. B. Rayton, of Bausch and Lomb Optical Co., told of new lenses recently developed for projectors; and W. C. Kalb, of National Carbon Co., told of the evolution of projection lighting from the first flickering arcs to modern controlled lighting systems. Other engineers of the same company, told of recent new developments in carbon arcs for projectors.

The interest which projectionists take in auditorium viewing conditions of the theatres in which they work was discussed by B. Schlanger, architect of New York City. H. Rubin, of Paramount Theatres Service Corp., approached the projectionists problems from the standpoint of supervision. Final paper of the session was by J. R. Prater, of Palouse, Wash., who spoke on the necessity for keeping accurate records of projection room operations.

● New Coated Lenses

A new technique which promises to revolutionize the uses and applications of optical glass in motion picture cameras and projectors, microscopes, binoculars, and in scores of other types of equipment by reducing the light losses caused by reflection, was described. The new development, which consists of coating lenses with a transparent film of the order of a millionth of an inch thick, was explained by W. C. Miller, of Paramount Pictures, Hollywood, and is a development of Dr. John Strong, of the California Institute of Technology.

By coating the lenses of a moderately-priced set of binoculars, Mr. Miller said, better aid to vision can be obtained than with most expensive instruments with untreated lenses. The same holds true of microscopes, and camera lenses of all types. He said movie projector lenses treated with the new film show a 50% increase in screen brightness. Motion picture producers have found that only 64% of the available light reaches the film when "shooting" with cameras having untreated lenses. Nearly all the brightness is photographed when the lenses are coated.

"Optical glass applications have to combat reflection which reduces the efficiency of the optical system by robbing the transmitted light beam from 4 to 5% of its brightness at every air-glass surface. Furthermore, the light thus subtracted may appear again in the form of flares where it is not wanted, spoiling the picture.

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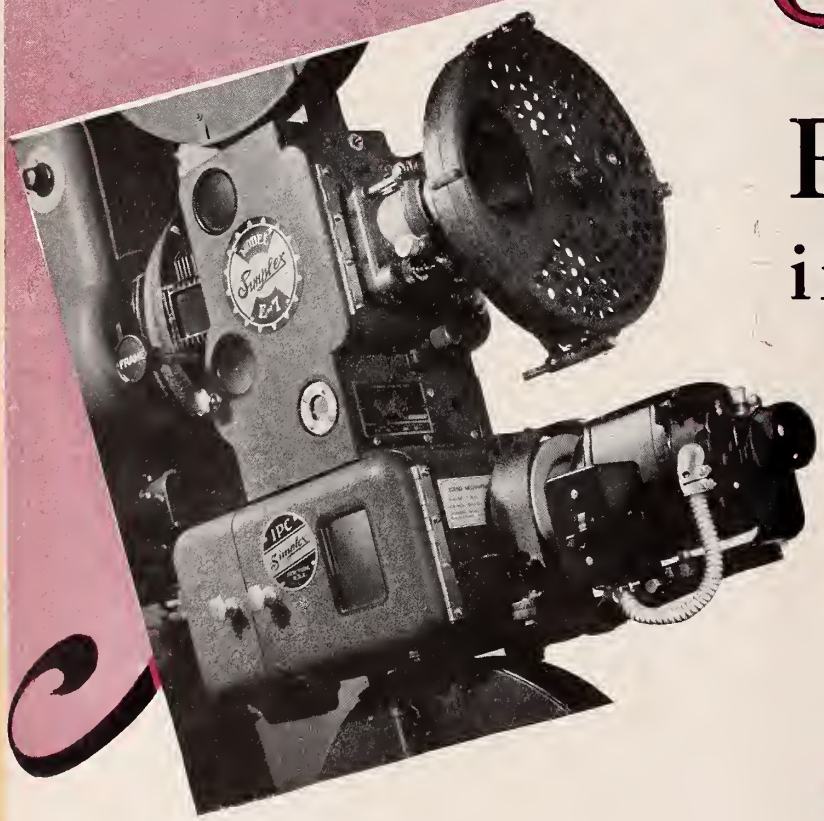
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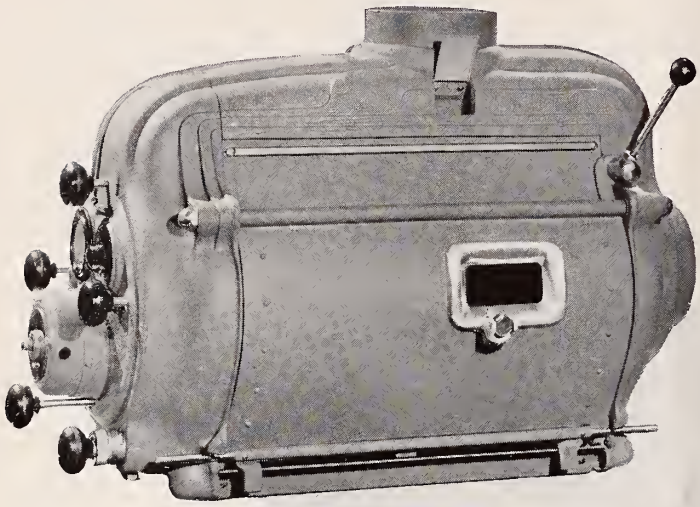
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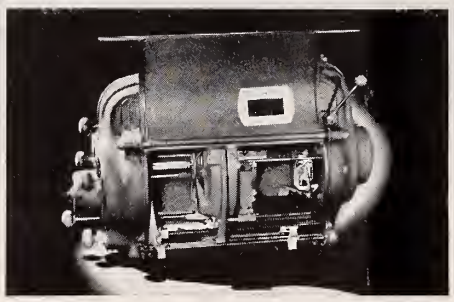


MODERATE sized theatres have long realized the hopelessness of getting a good picture on the screen with prevailing dense black and white films when using the dim low intensity lamp. Furthermore, satisfactory projection of colored films with the muddy yellow light of the low intensity was just as impossible. And the required brilliancy and sparkling snow-white light of the high intensity arc were denied them by prohibitive operating costs.

It remained for Strong, through the development of the new Utility, a perfectly balanced and coordinated lamp and rectifier unit of intermediate capacity, to solve their problem, to produce a high intensity lamp which exactly filled the needs of the medium sized theatres with screens up to 18 feet in width.

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Instructions for use

FILM-WELD should never be put into a container that has been used for film cement, or a brush used that has been used with film cement. Use FILM-WELD sparingly; just enough to moisten the film is sufficient, as any excess slows up the drying process.

On prints that have been treated with emulsion hardener, it is necessary not only to remove the emulsion, but the film itself must be scraped, so as to remove the hardener. The non-emulsion side should also be scraped.

Color film should be scraped on both sides.

FILM-WELD not being a cement but a bonding agent, it is absolutely necessary to remove any foreign matter so that the two films themselves are brought into contact.

If these directions are followed, a permanent bond will result.

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Edited by James J. Finn

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Monthly Chat

WE REPEAT our appeal to every projectionist organization to put their opposition to the pending Neely block-booking on record with their congressman. This measure, already passed by the Senate, is now pending before the House, the Interstate Commerce Committee of which is now holding hearings thereon. This bill will not only not help its independent-exhibitor protagonists but will actually do incalculable harm to the industry in the form of restricting production, limiting the supply of merchandise (film) available to theatres, and inviting rigid censorship by a governmental agency.

This bill, if passed, will positively result in the unemployment of many hundreds of projectionists, at least temporarily, thus for this reason, if for no other, craft opposition should be communicated instantly and in no uncertain terms to members of the House of Representatives.

• • •

A bow in the direction of Louisville in ole Kaintuck where the I. A. T. S. E. is holding its 35th Convention.

• • •

Elsewhere herein a timely editorial on the stereophonic sound recording and reproducing system that warrants the close attention of, and subsequent action by, every projectionist. Better informed on technical matters than any other group in the theatre field, projectionists should turn this knowledge to their advantage.

• • •

Three Springfield, Mass., projectionists, classing release prints as "general merchandise," advise I. P. of their firm refusal to inspect even a single foot of film. They assert exchanges should be held "criminally responsible" for damages resulting from defective film and equipment. This attitude is almost wholly responsible for the willingness of others to come in and do projectionists' work for them—not to mention the fact that no inquest to determine "criminal responsibility" ever was effective in breathing life into a corpse. If the boys intended to "burn" this corner, they succeeded.

• • •

In the next issue: a detailed report of all phases of activity at the I. A. Convention; additional data just arrived from England anent the mercury vapor light source; a roundup of opinion in the field relative to enforced inspection of film and equipment by all members of the organized craft, and more dope on the new carbon arc lamps.

• • •

By the way, what ever became of those grandiose plans for wide film of the order of 55 mm. or so?

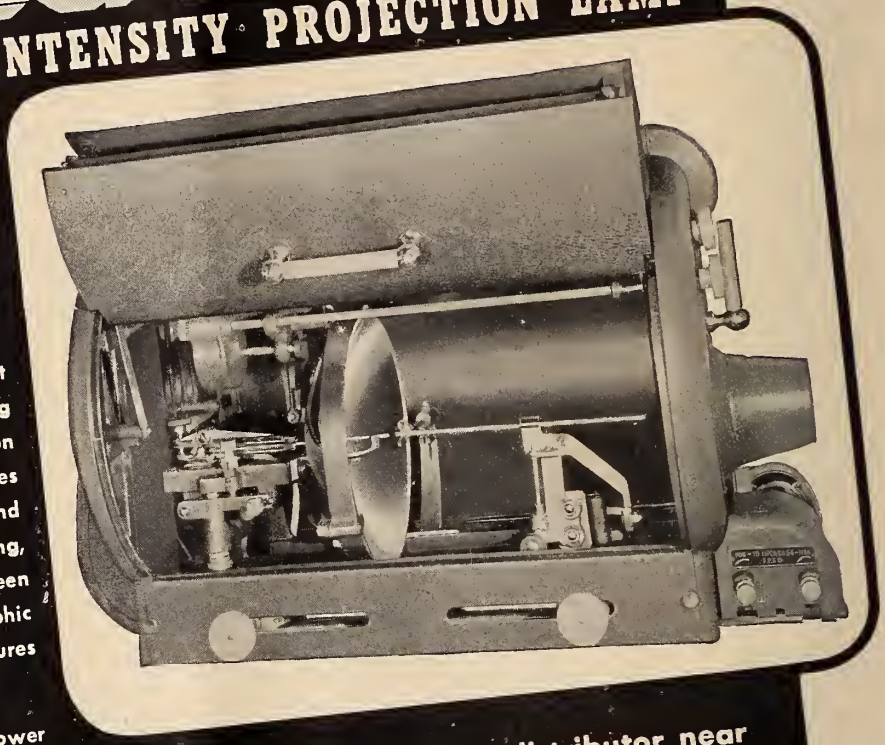


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ENGINEERS AND MANUFACTURERS

DETROIT, MICHIGAN, U. S. A.

INTERNATIONAL PROJECTIONIST

VOLUME XV MAY 1940 NUMBER 5

Fundamentals of Theatre Acoustics

By *J. E. VOLKMANN*
AND
K. C. MORRICAL

PHOTOPHONE ENGINEERING DIVISION
RCA MANUFACTURING CO., INC.

The acoustics of theatre auditoriums have never been regarded by projectionists as a topic of especial interest, such considerations usually being left almost entirely in the hands of those who have made a close study of this specialized art. It cannot be successfully disputed, however, that an understanding of the fundamentals particularly as applied to existing theatre auditoriums, is a requisite to a well-rounded understanding of sound reproduction. The accompanying article is a step in this direction.

THE sound in a motion picture theatre reaches the listener only after being influenced by the acoustic condition of that theatre. Regardless of how good is the sound emanating from the stage loudspeakers, the house acoustics indelibly leave their mark on it. If the theatre is correctly designed from the acoustic standpoint, it will "pass along" the sound so that it will arrive at the ear of the listener with all of its original naturalness and realism. On the other hand, if it possesses acoustic defects. the sound reaching the listener may be so altered in character that it is distorted, unnatural and wholly unsatisfactory to the listener.

In view of the present highly developed state of the recording art and the technical perfection of sound recording and reproducing equipments, it becomes necessary to give even more careful consideration than before to the acoustic design of the theatre in order that the ability of the equipment to reproduce a faithful likeness of the original sound at the ear be fully realized.

Let us start by asking, "What are good acoustics?" The requirements for good acoustics were probably first advanced by the late Professor Wallace C. Sabine as follows: "In order that hearing may be good in any auditorium, it is necessary that the sound should be sufficiently loud and that the simultaneous components of a complex sound should maintain their proper relative intensities, and that the successive sounds in rapidly moving articulation, either of speech or music, should be clear and distinct, free from each other and extraneous noises. These are the necessary, as they are the entirely sufficient, conditions for good hearing."

These basic acoustic conditions hold for any auditorium whether the sound therein is original or reproduced, although the manner of accomplishing or obtaining them may be different for rooms for different purposes.

Common Acoustic Defects

The ways to good acoustics can perhaps best be shown by pointing out some defects which often arise, showing how they effect the acoustic conditions of auditoriums, how they are related to high fidelity sound, and giving methods of correcting them, or, better yet, of avoiding them. These acoustic defects are reverberation, echo, resonance, poor distribution (loud and dead spots) and noise.

Reverberation, which is the "hanging on" effect of the residual sound in the auditorium, depends directly on the size of the auditorium and loudness of sound, and inversely on the amount of sound absorption within the auditorium. A quantitative value is given to this effect by defining the reverberation time as the length of time required for this residual sound to die away to one-one millionth of its original intensity, or to be reduced 60 decibels.

It can be found very simply by the relation $T = .05\ V/A$, where V is the volume of the auditorium and A is the total amount of sound absorption within it. A is found by multiplying each different area of material by its respective sound absorption coefficient, and adding. The sound absorption coefficient of a material is the percentage of sound energy striking it that is not returned to the auditorium, but is absorbed. For example, a material having a coefficient of 0.75 will absorb 75 per cent of the incident sound energy and reflect the remaining 25 per cent back into the room. It is this returned sound. which is reflected back and forth many times, that is reverberation in a room.

When it is considered that ordinary plaster walls have a coefficient not nearly this high, actually about 0.02. which means that 98 per cent of the energy stays within the room, it can

readily be understood how the sound tends to hang on. The sound absorption coefficient of a material will be different for sounds of different frequency, or pitch, and this ability of materials to absorb different sounds to different degrees is a very important one and one that has often led to trouble in practice.

Due to the extension of the low-frequency and the high-frequency ranges of modern reproducing equipments, greater precaution should be observed in choosing sound absorbing materials and treatment which will effectively absorb low and high frequencies. The choice of an efficient absorption material will insure a proper overall frequency balance in the auditorium. Some materials, like hairfelt, have a selective absorption characteristic and absorb a particular range of frequencies better than others. The use of such materials in the past has often resulted in a decided impairment in the quality of sound reproduction.

If the reverberation period is too long, both speech and music become blurred, due to the overlapping of successive syllables and notes. For good acoustics, the reverberation period should be relatively short, which means the auditorium should contain sufficient sound absorbing materials and should not be any greater in size than necessary. In existing houses which are too reverberant, it is necessary to add enough sound absorption to reduce the reverberation period to a satisfactory value.

At a frequency of 500 cycles per second, the time should be from 1.1 seconds for small houses up to 1.7 seconds for large houses. The period at the higher frequencies should be about the same as at 500 cycles per second; for the lower frequencies, a somewhat longer time, rising at 125 cycles per second to 150 per cent of the value at 500 cycles per second. is permissible.

● The Problem of Echo

Echo consists of a distinct repetition, sometimes several rapid repetitions, of the original sound. It is most often encountered in large auditoriums, particularly those with large curved ceilings and walls or other surfaces which are sufficiently remote from the source of original sound to cause a definite time interval between the original and reflected sounds.

Echoes are very annoying and their effect, like reverberation, is to blur speech and music. A multiple or flutter echo (several distinct repetitions) is often caused by parallel walls with smooth hard surfaces.

With the extension of the high-frequency range, the problem of echo and sound concentration is somewhat intensified because the high frequencies, or high-pitched notes, on account of their short wave-lengths, are more easily reflected by small smooth surfaces. However, the high-frequency echoes from these small surfaces are highly localized and may be easily eliminated by the usual methods—that is, by light drapes or other sound absorbing materials, or by breaking up the regularity of the offending surfaces by stepping, angling, *etc.*, thereby dispersing or scattering the sound striking them.

● Resonance Reduction

Since modern sound equipments generally use directional loudspeakers, the offending surfaces causing echo are usually the rear walls and corners of the auditorium. Other large projections from the ceiling and side walls which have a concave curvature or other shape which tends to concentrate or direct the sound, may also be contributing factors to the production of echo.

The phenomenon of resonance, or the ability to vibrate best at certain frequencies, may occur either in structures or in the air in rooms. Everyone, no doubt, at some time or other has noticed the tendency of certain notes to be over-emphasized in a powerfully resonant room, such as a small tiled room or marble alcove.

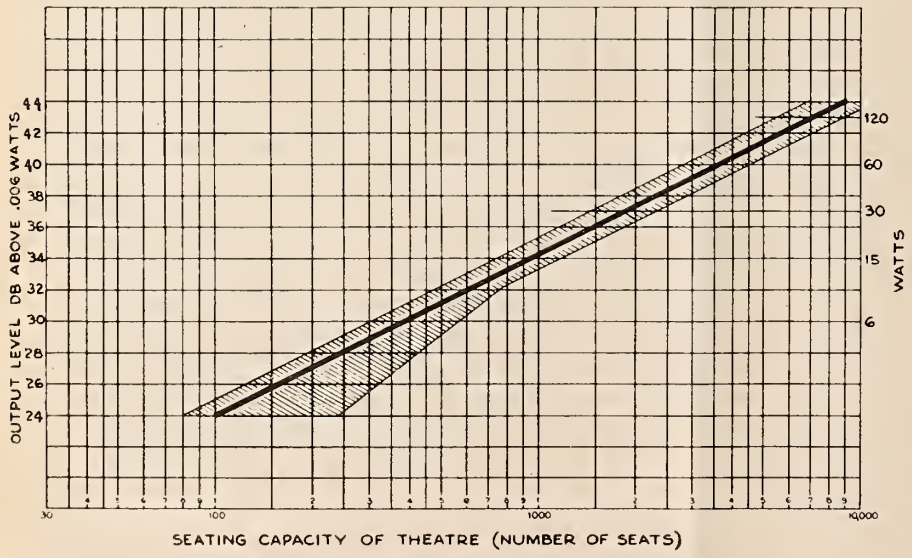
Structural resonance usually is not harmful unless the resonant body is mechanically coupled close to the source of sound. Sometimes resonance is a virtue, as, for example, the resonance of wood panelling in an auditorium is often a factor which improves its acoustic excellence, especially for music. However, this appears to be because the resonance does not occur at any one frequency but rather over many different frequencies, that is, the individual panels have many resonance frequencies and do not all tune to the same fundamental frequency.

Resonance in air chambers—such as the rear orchestra section under a balcony, alcoves, foyers, and even the auditorium itself—does not occur very often unless such chambers are bare of furnishings and have hard reflecting surfaces (usually parallel). To eliminate such resonance conditions on the stage, as well as to help reduce reverberation on the stage and the transmission of sound from stage to auditorium, absorbing material should be draped in the region around the loudspeakers.

● Faulty Sound Distribution

With the exception of the high-frequency sound concentrations already discussed, poor distribution of sound (*i.e.*, loud and dead spots due to the shape of the auditorium) can in most, though not in all, cases be overcome by the employment of the proper size and orientation of the cellular high-frequency horn. In those theatres which present stage shows as well as sound movies, the problem of poor distribution and inadequate loudness in remote seating areas can be solved, in general, only by sound reenforcement. Suitable sound reenforcement equipment of high fidelity is available today which increases the scope of musician and stage artist, thus enhancing the enjoyment of the prgoram. The same acoustic conditions should obtain in the auditorium for sound reenforcement as for sound movie reproducing equipment.

Noise may be defined as those sounds which are unpleasant and



*Amplifier output vs. seating capacity of theatre**

*Courtesy, Research Council, Academy of M. P. Arts & Sciences

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annoying. These sounds may be either of foreign origin or otherwise. Noise is undesirable not only because it detracts from the enjoyment of the entertainment offered, but because it has a masking and a frequency discriminating effect on the desirable sounds which, therefore, require added loudness or power to override the noise. Loud noises may also seriously limit the usable volume range of sound, thereby preventing a full realization of high fidelity reproduction.

A theatre with good acoustics has its walls insulated against the transmission of outside noises into the auditorium. The transmission of sound is of two kinds: (*a*) aerial, and (*b*) structural. Small openings due to doors, windows, port holes, *etc.*, transmit sound to a great degree. Thus, all the joints between walls, doors, windows, *etc.*, should be made as air-tight as possible.

Transmission of sound through structures, such as the noise from vibrating motors and machinery, can be minimized by using massive walls and floors and by separating all vibrating bodies from their supporting structures by sound insulating materials such as cork, lead, and rubber.

Massive walls are not always necessary to obtain sufficient sound insulation. A double wall of fairly light construction will give good sound insulation provided the two walls are not closely coupled mechanically by nails or cross members, that is, provided the walls are kept isolated or separated from each other.

The absorption treatment of the walls and ceiling inside the projection room, which has heretofore been neglected, is very desirable. Such treatment will result in the following: (*a*) reduction of noise in the projection room; (*b*) reduction of noise transmitted to auditorium; (*c*) increased efficiency of those working on the booth; and (*d*) possibility of better control of the volume by the projectionist because of the improved hearing conditions.

● Acoustic Treatment Guide

The following recommendations on the acoustic treatment which will give the theatre owner or exhibitor the best performance from his sound equipment, are offered merely as a guide. The services of a qualified engineer should be relied upon for the exact specifications relative to the proper type, amount and location of absorbing material, size and shape of auditorium, and type and amount of sound insulation required. In the case of new theatres, a noise survey of the proposed site and complete acoustic specifications for the auditorium are desirable and worth while.

1. All seats should be of the heavily upholstered type.
2. Heavily padded carpeting should be used in all aisles and corridors.
3. The rear wall being potentially the greatest source of echo, should be lined with an efficient type of sound absorbing material and/or sloped or otherwise shaped to direct the reflected sound to nearby audience or treated areas to prevent echo.
4. Curved surfaces should be avoided as much as possible. If employed, they should be coffered or designed to break up echo reflections and treated with sound absorbing materials.
5. Large unbroken surface areas, except when used for beneficial reflection, such as reflection from the splayed ceiling and walls at the proscenium, should be avoided.
6. Long narrow auditoriums, high ceilings, and excessively long and low balcony overhangs should be avoided.
7. The cubical content of the auditorium should be made as small as possible, compatible with the seating capacity and architectural design.
8. A rising or other slope in the orchestra floor should be used to give unobstructed "sound" lines as well as "sight" lines.
9. All auditorium walls should provide sufficient sound isolation to prevent extraneous noises entering the auditorium.
10. The projection booth should be lined with absorbing material and its walls sound insulated.
11. All machinery and ventilating noises should be isolated from the auditorium.

The aforementioned treatment will, in most cases, be sufficient for small sized auditoriums of the balcony type. Small sized auditoriums of the single-floor type and moderate size auditoriums of the balcony type, in general, will require acoustic treatment of the side walls with sound absorbing material of a moderate absorption coefficient. Moderate size single-floor houses and large size balcony houses, in general, will require side wall treatment with a highly efficient absorbing material. Auditoriums larger than these should have acoustic treatment on the ceiling as well as the side walls.

● Current Design Trends

Present design trends are in the direction of greater functional coordination between acoustic treatment and the different other services of a theatre, such as lighting, air conditioning, decoration, *etc.* Two factors have been instrumental in advancing this coordination: (1) the development of the principles of acoustic design to the state where acoustic specifications can confidently be included in the building specifications, and (2) the availability of a wide selection of acoustical materials.

In contrast to this idea is the older idea of "acoustical correction," meaning, as the name implies, the erection of a building first and then the addition of acoustic treatment to it as a corrective measure only after attempted use had proved how unsatisfactory was the original design.

As an example of such coordination can be pointed out the use of loosely woven fabrics behind which are placed rockwool blankets which provide the necessary sound absorption within the theatre and yet do not interfere with the decorative scheme which is carried out on the fabric. Acoustical materials which are designed so that painting does not destroy their sound absorbing ability are also useful for this purpose.

In the field of lighting, curved surfaces which are acoustically undesirable, have been replaced by surfaces of other shapes or re-designed so that desired lighting effects can be attained without the sacrifice of good acoustic design.

A novel feature in one new building has been the integration of acoustic treatment with both the lighting and the air conditioning. In this construction, the sound absorbing pad is spaced several inches behind a perforated metal pan, which is the front, finished surface. This space serves as a supply duct, or plenum, from which the air flows in channels formed in the pan.

This arrangement delivers air at low velocity over an extended area rather than the usual method of high velocities from smaller areas. This space also forms a convenient location for recessed light troughs, fixtures, *etc.*, which are flush mounted in place of the metal pan, with a resulting smooth harmonious appearance.

As time goes on, the continued coordination and an ever-increasing demand for correct acoustic conditions by more and more people will result in more building being satisfactory from the start.

SUE CALIF. DRIVE-IN THEATRE

Park-In Theatres, Inc., Camden, N. J., owners of Patent No. 1,909,537 covering drive-in theatres, has just instituted proceedings for patent infringement against M. A. Rogers and Thomas Burgess for operating without a license a drive-in theatre at Colton, Calif. An injunction and an accounting for damages are asked.

Pro and Con Views of the Switzer Electronic Carbon Arc Control

Brother projectionists "have at" each other in this clash of views relative to the practicability, or lack of it, of the Switzer electronic carbon arc control which was described in these columns recently†. Differences of opinion which induce such frank comment as that by these contributors cannot fail to be productive of progress in the art. Overall, Messrs. Hill and Switzer are apparently no farther apart than the numbers of their L. U.'s, 552 and 551, respectively.

I. P.'s view is that the Switzer arc control is entirely feasible, and that, with the incorporation therein of certain changes suggested by both parties to this discussion, the device should win ready acceptance by the projection field.

One thing is certain: whether it be the Switzer device or that of some other manufacturer, the widespread use of an electronic carbon arc control within two years is a foregone conclusion.

On The Negative Side—

FRANCIS L. HILL

MEMBER, I. A. LOCAL UNION 552

NOW, who is kidding whom? I read with enthusiasm the article relative to an electronic carbon arc control in the January I.P. I read it again and became confused; a third time and was bewildered.

First, it is called an "audio amplifier," but has a direct current input source. Direct current is fed to the grid of the first tube, which is transformer-coupled to the next stage. As the transformer will not transmit changes in direct current, the circuit becomes inoperative at this point.

But wait; there must be an alternating current from some unseen source in the circuit to account for the transformer. Just assuming there is an A.C. impulse going to the second tube, we find it superimposed on the normal plate current passing through the relay. Like any audio current, it will not cause a variation in the average plate current and the relay will not operate.

As I see it, the device cannot possibly operate as claimed.

Figure 1 is a reproduction of Mr. Switzer's diagram with the various units marked for identification. Fig. 2 is the same circuit redrawn with all units identical, except the omission of the connecting plug, the tube heater circuit, and the relay "S" which is used to disconnect the control-circuit input from the arc when the arc switch is open.

● Holds Relay Unnecessary

This relay is absolutely unnecessary as leaving the control input circuit connected at all times can certainly cause no damage to either arc or control circuit. It is a possible source of trouble by having the D.C. arc supply and the heater circuit electrically connected. Also, there is a possibility of the relay failing to make proper contact.

Mr. Switzer shows a series-field motor on the arc feed. This is the first time I have encountered this type of motor for this service. I am quite sure this is an error, as series-field motors vary their speed greatly in inverse ratio to the mechanical load. A shunt-field motor will vary its speed in proportion to the voltage supplied to it, with no speed change for small variations in load.

In paragraph one on page 8 Mr. Switzer speaks of the "relay controlling the fields" of the arc feed motor, whereas the diagram shows that it controls the series resistance to the entire motor.

The entire resistance network of R-2, R-3, R-4, R-5, and the voltmeter as connected form a simple resistance unit which could be replaced by one resistor. The grid voltmeter does not read true grid voltage unless R-4 is a very low resistance. If for control setting purposes an identical reading on both meters is wanted, a simple voltage dividing network would be just as efficient.

In the last paragraph on page 7, "No. 2 meter" is in the grid circuit and "No. 1 meter" in the cathode circuit. In the second paragraph on page 8 "No. 1 meter" is spoken of as being in the grid circuit and "No. 2" is called a "grid bias meter." Both of these meters register bias voltages of the vacuum tube, one being a grid circuit bias, the other a cathode bias meter.

In the next paragraph a "1/10-volt change" in voltage is mentioned. Obviously this means a change of 0.1 volt in the meter reading, which would be many volts at the arc. The ratio between the arc voltage and voltmeter reading depending upon the values of resistors in the circuit.

● Question of Meters

Why all the stress on the sensitive voltmeters? Both meters are shunted by resistors which eliminates any advantage gained by an expensive high-resistance meter. Also, the resistance of the meter has nothing whatever to do with its ability to register changes of 0.1 volt. Any good 10-volt meter with properly calibrated scale will do this.

Furthermore, why are meters necessary? The desired arc voltage and the desired grid voltage (depending upon the characteristics of the tube) are both fixed and known. The necessary resistance values can be readily computed. Either two resistors, or a tapped

†"An Electronic Carbon Arc Control," by George W. Switzer, I. P. for Jan., 1940, pp. 7-8.

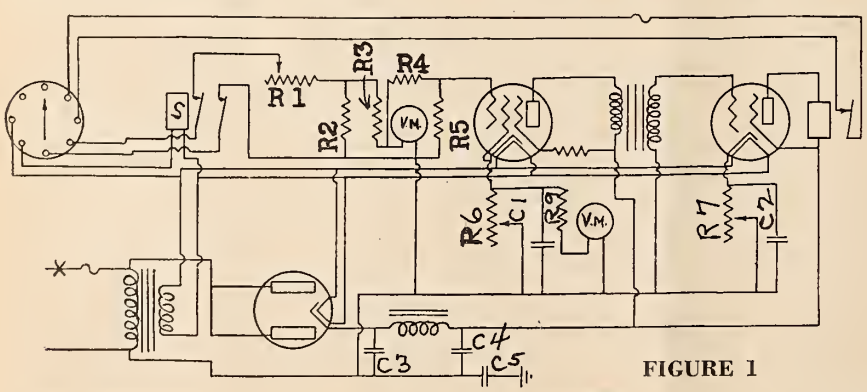


FIGURE 1

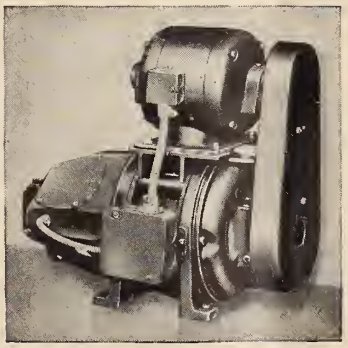


Wow! THIS MUST BE ANOTHER Cyclex INSTALLATION

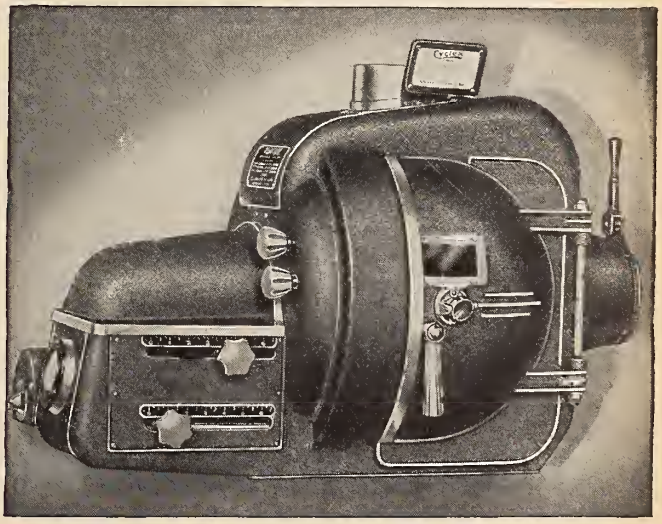
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Reel-End Signal

Does not touch the film or reel.

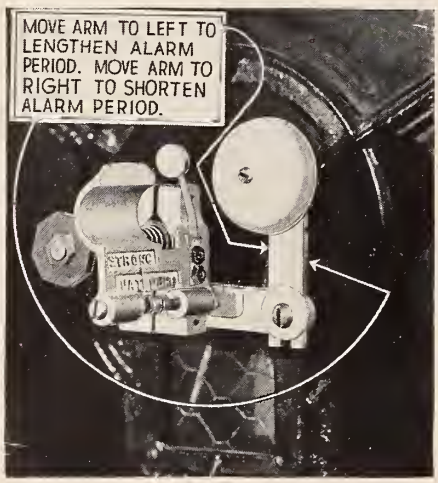
Is strictly mechanical and requires no batteries, no transformers, no governors, and no pre-setting by the projectionist.

Is not dependent upon any change in the normal smooth operation of the projector.

Is installed within 5 minutes, requiring no drilling.

Once installed, forget it—as was conclusively demonstrated by 1200 tests under practical conditions in various projection rooms.

About 75 seconds before the end of the reel the bell begins to ring, continuing distinctly for 15 seconds, after which period of time it ceases. The duration of the bell-signal can be increased or decreased about 15 seconds by simply moving the arm to either the left or the right.



The Strong Reel-End Signal Is

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Zipper Changeover

ZIPPER Changeovers for all models mount directly on the projector at the aperture and can be installed within 10 minutes without any drilling or tapping, etc., and require no brackets! A new-type treadle foot-switch, utilizing an unbreakable mercury switch, eliminates all switch trouble. Weighs only 20 ounces; guaranteed against trouble for one year after purchase.

The combination Sound-Vision Changeover is now available in all ZIPPER models for use with any RCA sound installation. This method of changeover is EXCLUSIVE with the STRONG ZIPPER, being fully covered under U. S. Patent No. 1,796,970. These combination models for RCA systems are priced at $125 per pair, including foot-switches.

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With Treadle Mercury Switches: $75

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or adjustable resistor, can be used and need only be set once.

Adjustment to regulate desired arc length could be made by variable cathode bias resistor. If the arc voltage is too high simply decrease the bias resistance, or *vice versa*. No meter is necessary.

In the first paragraph under the subhead Voltage Variations: "If the voltage (A.C. line voltage is meant) rises, the grid bias also rises a little in proportion. . . ." This means that increased A.C. line voltage will cause increase in plate current and the resultant increased drop through cathode resistor will make the cathode more positive in reference to grid.

In the next paragraph, ". . . as the generator voltage rises . . . the grid bias is raised. . . ." This means that as the arc voltage rises the grid becomes more positive with reference to the cathode.

These two statements are conflicting as in one paragraph the grid becomes more negative in relation to cathode, while in the following paragraph the grid becomes more positive in relation to the cathode and both of these conditions are designated as *rise in grid bias.*

Referring to Fig. 1 again, it will be noticed, if traced through, that the negative terminal of the arc is directly connected through the control circuit, to the grounded side of the A.C. line. This is an undesirable and unsafe situation. If the generator is not grounded it becomes grounded, or rather connected, to the A.C. line. If negative leads from two lamps should be connected differently either through rheostats or other devices, the electrical connection of both negative terminals of lamps through their respective control circuits and the A.C. power line might produce interesting if not disastrous results.

● Superfluity of Material

As one (non-fused) side of the A.C. line is grounded, the condenser C-5 plainly serves no purpose whatever. If this is designed to be a D.C. control

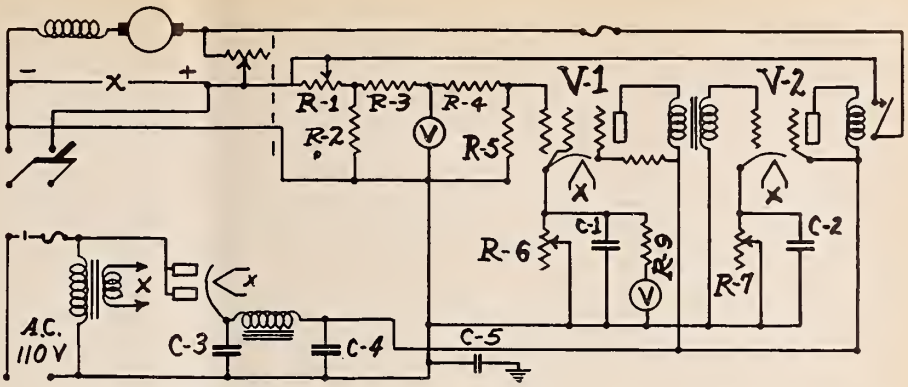


FIGURE 2

circuit, and no A.C. being present in the tube circuits, the cathode by-pass condensers C-1 and C-2 are also unnecessary. The resistor R-9 in series with the cathode voltmeter is a clear case of padding the material list.

There is a duplication of wiring through the connecting plug, as three wires go to the positive terminal of the arc. Only three wires are necessary to connect the control to the arc, which will simplify matters for the boys that "build their own."

A fuse is shown in the circuit between the relay and the arc feed motor resistor. By no stretch of any one's imagination could an increase of current occur in this circuit which would require fused protection. If the motor should become short-circuited, the regular fuses furnished as part of the arc control are sufficient.

● His Own Control Idea

I think the brother projectionist has a good idea here, but he has made it appear unduly complicated and he should not have given out a diagram which is going to cause many wasted hours and dollars by projectionists who take for granted his statement that "it works."

After taking the contraption apart rather thoroughly I would suggest the following: Simplify the input circuit. Eliminate the relay "S" in input circuit. Eliminate one voltmeter and use transfer switch with one meter. Direct coupling between stages of amplifier. Use a transformer with separate high-voltage secondary winding to eliminate interconnection between A.C. and D.C. power sources. Install relay or switching device to close A.C. power circuit when arc switch is closed. Put condenser across winding of plate circuit relay to prevent chattering on small voltage variations.

Figure 3 shows my own theoretical design of a control circuit operating on a similar principle but with extreme sensitivity. Theoretically it works as follows: Arc voltage is impressed across R-1. Using a hypothetical arc voltage of 40, this makes the grid of V-1 40 volts positive from reference point, which is taken to be the common negative of arc and control circuit.

● Hill Circuit Data

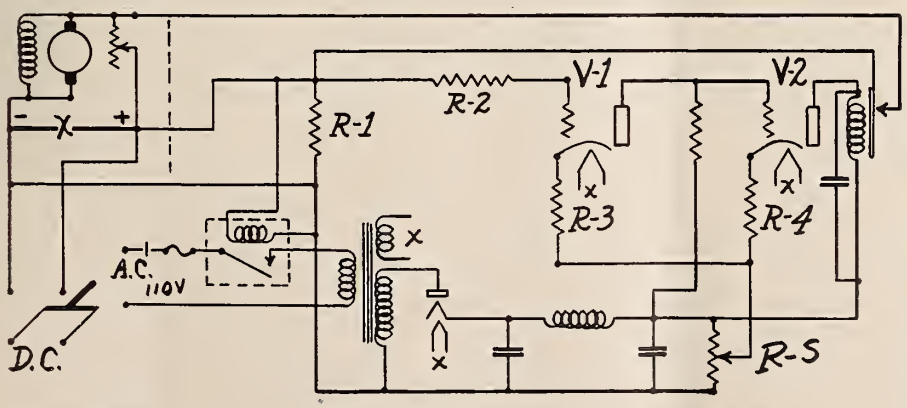
Cathodes are biased to approximately 40 volts positive from same reference point by means of potentiometer R-5. Adjustment of R-5 will set bias of V-1 so that no current will flow in plate of V-1 when arc is at normal voltage.

If arc voltage increases, one volt for example, this entire increase in voltage will be impressed on the grid of V-1, causing plate current to flow. The IR drop in R-6 will cause the grid of V-2 to become more negative and reduce the flow of plate current in V-2, causing relay to be de-energized, closing contacts and increasing speed of arc feed motor to bring arc voltage back to normal.

Bias resistor R-4 will have to be high to counteract the positive potential on the grid of V-2. Potentiometer R-5 will have to be of relatively low resistance so that changes of plate current flowing back through it from cathodes will be relatively small compared to the bleeder current through the pot, and thus not change the bias voltage.

In the operation of the circuit, the plate current in V-1 will increase, while the plate current in V-2 will

FIGURE 3



decrease. This to a certain extent will automatically balance any change in current through R-5.

With a constant-voltage generator supplying the arcs, the tube bias (cathode) could be obtained from a potentiometer across generator terminals ahead of ballast resistors. As the D.C. voltage of a good multiple generator is steadier than the average A.C. line voltage, this might give even better control.

'Taint So, Says Sponsor of Arc Control

By *GEORGE SWITZER*

MEMBER, I. A. LOCAL UNION 551

MR. HILL's observations anent my electronic arc control make me mindful of the adage that nothing would be accomplished in this world if all possible objections thereto had first to be overcome. There is always someone to say "It won't work" when something new is introduced. They have been saying it for years, and I believe at one time they threatened to close the Patent Office because there was nothing new to invent. Knowing this, and having already received such letters saying as much about my electronic carbon arc control described in I.P., I shall try to make the control a little plainer.

First, let me make it clear about the tubes in the circuit. I use the tubes I do because the C-J-7 has a low negative bias cut-off, and the 6-F-6 has quite a bit of gain for small input; also it can handle quite a load in the output. As one correspondent said: "Why use all the resistors in the input circuit when one resistor could do the work just as well?"

Now, every resistor in the input has a different purpose. We will start with No. 2 in Fig. 4. This resistor cuts the arc voltage down to a level that can be easily handled. No. 4 resistor is for the purpose of steadying the voltage change which is applied to the grid of the tube. The reason for this is that with the gas ball we have at the Suprex arc, and the way the voltage is changing, we could not do a thing with the grid of the tube because the change is too fast.

Let me say here that the voltage at the arc isn't really d.c. in one sense of the word. I don't know just how to explain it, but will do so in this way. The carbons are burning at a given rate. Now, in order for the carbons to burn there has to be a voltage change in proportion to the burning rate. This sets up, in one sense of the word, an alternating voltage, because for every fraction of a second the arc is burning there is a tendency for the carbons to move further apart, thus causing a voltage change at the arc. The arc feed motor is propelling the carbons forward to offset this voltage.

In doing this, it can be seen by anyone that we never have a real steady voltage at the arc. Of course, this miniature voltage change cannot be detected with an ordinary meter but when applied to the grid of a tube it has the same effect as though it were A.C. being applied to the grid. This is why we can use an audio transformer in the control.

Now, after getting the voltage down to where we have complete control over it, we still have too much to put on the grid of the tube. That is the reason for resistor No. 5, which drops it to the desired voltage.

About the meters it has been said: "Why use expensive, highly sensitive meters?" Well, as we all know, the average voltmeter with, let us say, 70 or 100 ohms per volt, takes more current to operate the meter than we use in my electronic carbon arc control. As for the meters being expensive, they are very inexpensive, for they are only 0-1 milliampere meters, with resistor Nos. 12 and 11 in series with them to make them read the voltage we want.

In other words, we have 10,000 ohms in series with these meters in the control to make them read 10 Volts. The same holds true if, when we wanted to read 100 Volts, we would put 100,000 ohms in series with the meter, and so on. In either case we would only be taking one milliampere from the source we were measuring if we had a full-scale reading. If half-scale reading, one-half milliampere, and so on.

After the voltage drop, we get through resistor No. 5 to the grid of the tube, it is in the neighborhood of 12 microvolts, or 12 one-millionth of a volt. If the grid were allowed to float with this voltage on it, we couldn't do a thing with it, hence the insertion of resistor No. 6. Now, the larger is this resistor the more sensitive the control will be, and the smaller, the less sensitive.

Now, of course, the control can be built without any meters, and it will work. But the reason for the meters is to take all guesswork out of the arc feed. There has always been too much guesswork on all arc controls. That is the reason that, when I designed and built this electronic carbon arc control,

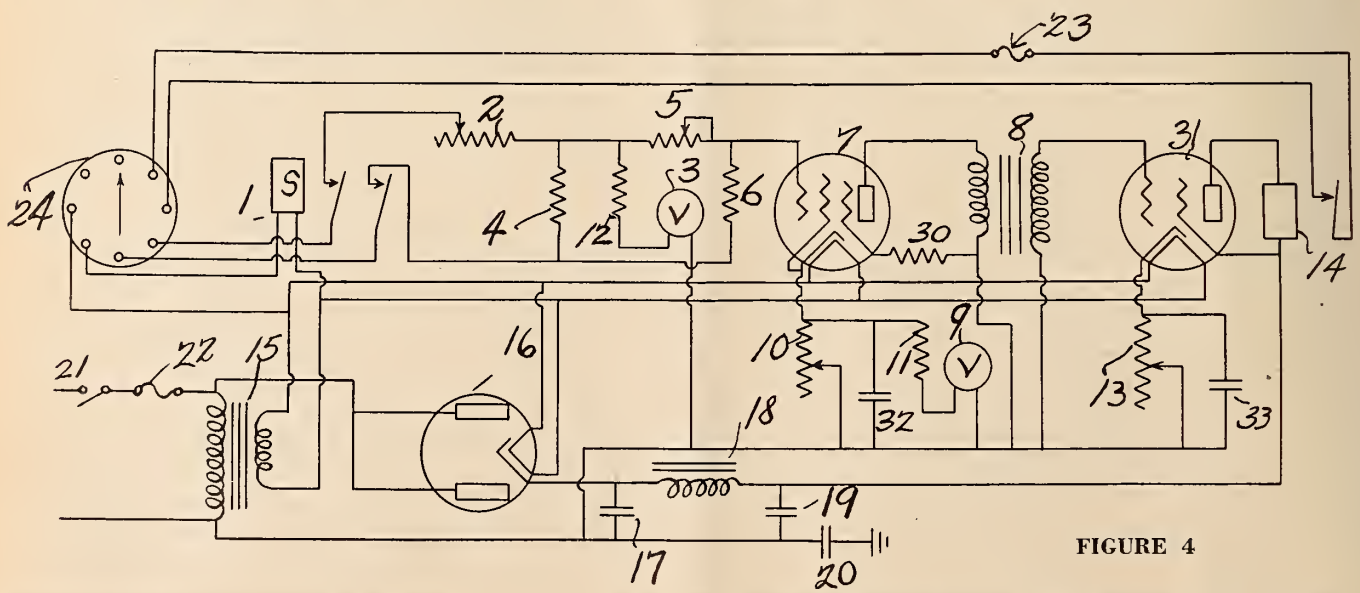


FIGURE 4

I put meters on it so the projectionist could see what he was doing, instead of turning a knob and praying that he got the right setting. Now he *knows* he has it.

You will notice that a half-wave rectifier is used. The reason for this is that we do not want the plates of the tube to be completely positive, because then it would take too much charge on the grid to get the same effect in the output. What we are really doing is counter-composing the voltage change at the arc on an A.C. ripple.

If one will take the pains to study the diagram, he will see that the control is floating on the line, and isn't grounded in any way, only through an .01 mfd. condensor to ground, which is for the purpose of preventing electric shock in case one touches the control.

Fig. 4 shows that the 110-volt A.C. line is being rectified, for the reason that at the time I built the control I couldn't obtain a transformer with the desired secondary voltage I wanted to use. I now have a transformer in place of using the 110-volt A.C. line. This transformer, specially made, also does away with relay No. 1, which was for the sole purpose of disconnecting the control from the arc, so there would not be any chance of electric shock while trimming the arc.

Figure 4 shows a series-wound motor to feed the arc. I know that most of the lamps have a shunt-wound motor. But that is a mere detail, because the kind of motor used doesn't have a thing to do with the way the control operates. All that is necessary is to put the relay contacts across whatever kind of variable resistance one has for controlling the arc feed motor.

Now, this resistor is set so that the motor is just turning over, and when the relay closes the resistor is shorted out, the motor runs at full speed and will do so until the proper arc gap is obtained. But the relay is so sensitive that it works at the same speed at which the carbons are burning and keeps the motor running at just the right speed. So there is never more than 1/32 of an inch difference in the arc gap.

To those who do not believe that the control will work I should like to point out that I have had this control in constant operation for at least eight months on all kinds of lamps in some of the largest theatres in San Francisco. At every place where it was tried the projectionists were more than pleased with it and wanted me to build the control so they could put it on their lamps. The managers at these theatres were also enthused, and were ready to buy the controls at $175 each, which was the price I quoted. If this control didn't back up the claims I made for it, they certainly would not want to buy it at any price.

Now, a word about the new Suprex Low Intermediate Lamps. After reading Mr. Harry Strong's article† on how difficult it was to keep an arc with low voltage, I ran several tests with different voltages at the arc, using my electronic arc control. The lowest voltage I tested it at was 26 volts at 38 amperes. I let the Arc burn more than thirty minutes at that voltage, and didn't have to touch the controls.

As stated previously, this control will work on any kind of arc at any voltage, for the simple reason that we are using only a portion of the arc voltage to operate the control and we have complete control over this at all times.

It has been said that such a control can be simplified and that there isn't any use in having two meters, plus a few more things like this, part of which criticism I know is correct. I know that the control can be simplified, and I know it can work without two meters. But I want to emphasize the fact that my control was not built "down to a price."

†"The Intermediate H.-I. Suprex Lamp: Design and Operating Data," in I. P. for Jan., 1940, p. 23.

This electronic arc control was built for projectionists by a projectionist. It was developed in the projection room where eventually all new ideas from the laboratory have to be hashed over until they work perfectly. And this work always falls on the shoulders of the projectionist on the job.

In fact, this control was developed under the worst kind of conditions. First, I have a 55-ampere generator, and I am pulling between 45 and 50 amps. When both arcs are burning I am overloading the generator almost 50 per cent. Everyone knows that when both arcs are struck on a small generator like that, the voltage is bound to fall off some. But my control still keeps the carbons at the proper distance.

Furthermore, I have Preddie lamps which are just the old low-intensit lamps "grown-up" with a larger mirror. As there is only one screw to feed both positive and negative carbons, there is no way to vary the speed of the negative carbon as in the better class lamps. If the control will work under these conditions, on good equipment it will work even better. I hope I have made the control clear to everyone. If there are any intelligent questions anyone would like to ask, I shall be more than glad to answer them.

I. A. 35th Bi-Ennial Convention in Louisville

THE Thirty-Fifth Convention of the I. A. T. S. E. & M. P. M. O. U is assembling in Louisville, Kentucky, as these lines are written, with more than 1,000 representatives of Local Union organizations ranging geographically from the Maritime Provinces of Canada to distant Hawaii, and including the Bahama Islands, in attendance. Convention headquarters is the Kentucky Hotel.

Not a little preliminary work is slated for the various district meetings which get under way on May 31 and continue through June 2. Resolutions okayed by the various districts are of compelling interest to the Convention as a whole and usually receive the approval of that body.

● Expansion Moves Indicated

Pre-Convention days were marked by an almost complete absence of political maneuvering, with President George E. Browne expected to be re-elected without opposition for another four-year term and thus complete a stretch of ten years in that office. No changes in the other offices of the organization are anticipated, with the possible exception of the addition of one vice-president.

Dual organizations having been eliminated except in a very few widely scattered sections, this question is expected to yield its primary importance of former years and be supplanted by questions relating to a further expansion of I. A. unionism in several comparatively new fields, including the rapidly-expanding 16 mm field, the television industry, and the outdoor amusement enterprises. Action on theatre treasurers, managers and other front-of-the-house employees is also anticipated.

Jurisdictional disputes involving the I. A. having been conspicuously absent during the past several years, scant attention will be paid to this topic. Unfounded rumors relating to an alleged "award" of jurisdictional rights to portable projection work to the I. B. E. W. will likely be effectively disposed of in resolutions bearing on the 16 mm question.

The extension of servicing activities by the sound system servicing organizations, concerning which much talk has been heard, particularly among

the smaller locals, will undoubtedly receive special attention by the Convention. The attitude of the majority of I. A. units to this question is not known at this writing, thus it remains for the Convention to provide a definite and conclusive answer to the many questions posed anent this topic.

The equipment displays which attracted so much attention and favorable comment from the delegates to the last two conventions will again be a feature of the Louisville meeting. A score of manufacturers are expected to exhibit their very latest products.

The usual detailed report of all phases of Convention activity, including an analysis of the more important resolutions adopted, will appear in the next issue of I. P.

30th Anniversary of Boston L.U. 182 'Tops' on All Scores

EASILY the outstanding affair of its kind ever attended by the writer, judged from any angle, was the 30th Anniversary Party held by projectionists' Local 182 for 800 guests at the Copley-Plaza Hotel, Boston, on May 1. The hotel management said it was "the greatest party ever," so that settles that.

Here's the story: First, every theatre in Boston closed at 11 p. m., which ranged from 15 minutes to an hour early, the managers reversing that old slogan that "the show must go on" so that all men could reach the party for the start. Is that one for the book? And that's not all. A manager contributed the giant birthday cake, and spotted around the banquet hall were about 150 managers and assistants "on their own".

Outside the hotel was an 800,000 c. p. Government spotlight (well, anyhow 600,000) which gave the affair that old Hollywood touch. Just inside the entrance was as classy a display of projection equipment dating from the '90's to 1940 as was ever offered. A couple of the antiques baffled all the oldtimers. Then to an hour's cocktailing cuffo; then to a sumptuous meal, including champagne and—er—well, other stuff. Payoff is that whole layout cost individual member only the price of his ticket, Union treasury not being tapped for a dime.

Entrance featured a splashing perfumed water fountain, while main room was blaze of light from the moving cloud effect on the ceiling to the kaleidoscopic shafts of spots, color wheels and what have you. Entertainment via top-line acts from screen, stage, radio and night clubs was given until it ran out of the guests ears. Picture show also featuring *The Great Train Robbery*, other old reels including John Bunny sequences (he was first gold car member of L. 182 for participating in first Boston Labor Day parade in 1910) and illustrated song slides.

Piece de resistance were moving pictures shown two hours after party started of every theatre marquee in town displaying current attractions in lights, plus movies of *every guest* photographed as they entered the banquet hall. A great party, a great show of cooperation by every member of L. 182, a great tribute to Union Labor by the managers, and an inspiration on the score of cordial industrial relations to organized men everywhere. Thad Barrows was General Chairman of the affair, and Jimmy Burke was General Secretary.—J. J. F.

Full Commercial Tele When Single System Is OK'd

Full commercialization of television was promised in the latest report of FCC as soon as industry engineering opinion is prepared to approve any of the present competing tele systems. In unanimous action the FCC announced it will promptly license applicants to "provide further experiments on the different systems on a comparative basis."

Additional cities under consideration by FCC for tele facilities include San Francisco, Los Angeles, Chicago, Washington, Albany, Cincinnati and Boston.

"It is essential to the progress of television," the report states, "that there be not a mere semblance of competition, but that there be a genuine and healthy competition within an unfettered industry. The American system of broadcasting has been established by the Congress on a competitive basis. Television will be an important part of that system.

RCA Television Slant Rejected

"It is obvious that the industry as a whole does not share the RCA view of forging ahead regardless of untested possibility of improvements on the horizon. It further appears that the industry was not prepared to accept David Sarnoff's promise of 'we live on obsolescence,' as a basis for justifying a heavy public investment at current levels of efficiency."

Widespread public distribution of sets of a system operating on present levels, the FCC holds, will undermine incentive for further advance in tele broadcasting and make frozen tele standards an accomplished fact. Revised rules to make effective the conclusions reached in last night's report will be issued in the near future, the FCC announced.

When a W.E. fader requires cleaning every few days to keep it noiseless in operation, clean the ground plate and contact studs where the wiper contacts them with 000 sandpaper just sufficiently to polish the metal nicely. Then coat the surfaces lightly with white vaseline. This treatment should reduce need for cleaning to once in weeks or months, depending upon operating conditions.



General view of banquet hall during Boston projectionists' Local Union 182 30th anniversary celebration.



Well Joe!

I'VE PUT IN THAT PAIR OF "ONE KILOWATT" ARCS

● Believe me, they are the real thing. These low wattage High Intensity arcs mean a lot to the small theatre.

You ought to see the difference in my screen light — I wouldn't have believed it possible.

Do my patrons notice it? You bet they do! I defy anyone to put on a better show either in color or black and white.

And you'd be surprised, Joe, how little it costs to install and operate these new arcs. It's the best investment I've made in a long time.

You'd better get on the band wagon!

THE NEW "ONE KILOWATT" ARCS USE "NATIONAL" "SUPREX" AND "OROTIP" CARBONS.

HIGH INTENSITY CARBON ARC LAMPS

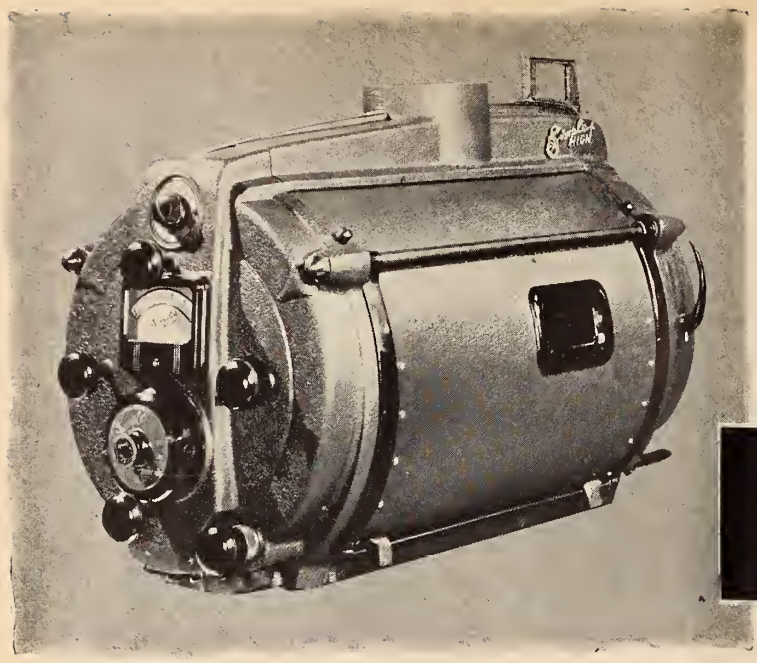
supply all the spectral colors in essentially even balance. That is why they give true color reproduction.

The words "National," "Suprex" and "Orotip" are registered Trade-Marks of National Carbon Company, Inc.

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The SIMPLEX HIGH intermediate capacity arc projects twice as much light as the low intensity. It has been designed especially for theatres of up to 800 seats and using screens as large as 18 feet in width.

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The SIMPLEX HIGH is a high intensity, direct current arc which projects the snow-white light which is so necessary to the projection of colored pictures.

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The SIMPLEX HIGH has been designed and priced for theatres heretofore restricted to the use of low intensity lamps because the operating, if not the original, cost of the earlier high intensities has been prohibitive. The overall operating costs are only slightly higher than with the low intensity, because this arc operates at only 27 volts as compared with 55 volts in the low intensity, and each 14-inch, 7 mm. Suprex positive carbon burns for at least two hours.

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The SIMPLEX HIGH is another example of SIMPLEX engineering excellence. The name SIMPLEX on any projection product for years has been your guarantee of quality.

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The I P EDITORIAL PAGE

Vol. 15, No. 5 MAY 1940

The Low-Down on Stereophonic Sound Systems

The pronounced tendency on the part of the motion picture industry, and particularly the exhibition branch thereof, to water the leaves and neglect the roots of a given problem has been the topic of rather extended comment in these columns over a period of years. This tendency was never so aptly displayed as in connection with the recent demonstration by Bell Telephone Laboratories of what is termed Stereophonic Reproduction From Film. Apparently it required but one look at the fulsome press reports, public and trade, of these demonstrations to induce a violent reaction due to extreme fearfulness on the part of exhibitors generally (and, we regret to say, a few projectionists who should know better) that the industry was again on the threshold of a "technical revolution" comparable in importance and cost with the introduction of sound motion pictures. Such a reaction to the stereophonic reproduction demonstrations is silly beyond description, for the following reasons:

I. P.'s report of these demonstrations† was preceded by a foreword which stated, in part:

> "The system as demonstrated in New York is of enormous power and beautiful quality, *but, as its sponsors admit, its practical application in the motion picture industry, is extremely doubtful at present.*" [Italics ours.]

Practically every unit of the non-technical industry press overlooked this vital admission by the sponsors of the stereophonic system: they simply gave the story an overall ride and let it go at that, totally oblivious to its probable effect upon their readers. For I. P. readers, however, this should have been the tipoff. For the benefit of those who still may be a bit wary, let us have a look into a few technical and financial aspects of the stereophonic system:

Even conceding that the film producing companies might consider installing the large amount of additional equipment necessary and changing their entire technique of recording (which in itself would seem to be a monumental consideration) what is Mr. Exhibitor going to do about adopting it for his theatre?

Certainly it would appear that there is no room on the present standard film for the two additional tracks required. which simply means that additional reproducing equipment will have to be installed in the projection room, to say nothing of a greatly increased amount of power which would be required for satisfactory amplification through three amplifier channels plus the control channel and three sets of loudspeakers behind the screen. This means that the industry must expend a tremendous amount of money to put over such a project. What benefit could thus be derived by the vast majority of theatres throughout the country is a moot question. Projection room space and the space backstage is generally at a premium, and in most cases there is hardly enough space allowed for the equipment at present installed.

†"Stereophonic Reproduction From Film," by Dr. Harvey Fletcher, I. P. for April, 1940. pp. 14, 17, 18.

What benefits could be expected from stereophonic reproduction in theatres having a seating capacity of, say, up to 1,200, of which there are thousands operating? Admitting the advantages of stereophonic reproduction in large de luxe theatres where screens are wide enough to get some benefit from the position in the picture from which sound emanates, how much benefit could be obtained in the smaller houses with relatively small screens, except maybe from the seats comparatively close to the screen? We cannot believe that stereophonic reproduction would prove any great advantage in this great number of theatres.

The suggestion for stereophonic recording and reproduction is, of course, not new. As a matter of fact, at least one equipment manufacturer has provided equipment on which, with relatively minor modifications, straight dual track stereophonic recordings can be satisfactorily reproduced. It would seem that if stereophonic recording is considered such a tremendous advantage to the entire industry insofar as reproduction is concerned, the producers would have taken at least this step forward long ago. Such a step would have cost the industry but a small amount as compared with the large sums that will have to be spent for changing-over existing equipment and adding new equipment to it, or providing completely new equipment to assure satisfactory reproduction under the present proposal of Bell Laboratories.

We can only surmise that Mr. Producer does not believe stereophonic reproduction would benefit greatly any but a very few theatres and is therefore wisely not proposing to try to induce the industry as a whole to invest the colossal sums of money which evidently would be necessary for the average exhibitor to reap little or no benefit. We think the industry has become too much disturbed over this proposal of another revolution in sound. It is our opinion, notwithstanding the apparent wonderful theoretical, and maybe practical, possibilities where large theatres are concerned, that it will be a long, long time before any such proposal is seriously considered by those who in the final analysis must foot the bill.

Present-day reproduction, where modern first-class reproducing equipment has been installed, is fast reaching peak performance, and all hats should be doffed to the technicians in the studios who have done such a marvelous job and to the manufacturers of modern sound reproducing equipment who provide the apparatus through which current film recordings are so faithfully reproduced.

Our advice to the thousands of theatres who are even now operating far below par with obsolete sound reproducing equipment is to take advantage of present possibilities by installing modern reproducing equipment for the reproduction of present-day recordings. Don't forget the push-pull bugaboo which constituted "a major threat" not so long ago. What happened to it? Answer: nothing.

So there you have it. Boiled down, this question resolves itself into the plain fact that stereophonic reproduction is as remote from practical general application in the exhibition field as is Hitler from Heaven. Supple-

(*Continued at foot of next page*)

Advances in Optics, 16 mm., Television Feature S.M.P.E. Progress Report†

Of outstanding importance in cinematographic progress in the past year has been the introduction of coated lenses, a revolutionary advance. The use of fine-grain film in variable-density recording and printing is another great step forward. The 16-mm. field, recipient of much aid from high-speed emulsions making possible photographing and recording directly, will expand greatly. Television has benefited by improved lighting technique, due to utilization of mercury arcs to provide cool lighting.

IN THE field of cinematography there has been little to report this year in the way of new emulsions. The only item of outstanding interest is the introduction of coated camera lenses to reduce surface reflections. This improvement promises to have revolutionary effects in this field. In the amateur field many high-speed emulsions have been made available for the first time to the amateur, and there has been considerable improvement in projection equipment in both 16-mm and 8-mm fields.

The excellent pictorial and sound quality now obtainable by the 16-mm medium is making it possible to photograph and record directly on 16-mm film, thereby opening up a vast field for the 16-mm technic.

In the field of sound recording one of the most significant advances of the year has been the use of fine-grain films in variable-density recording and printing. The use of these films brings about a marked reduction in ground-noise as well as improving the quality of the reproduced sound.

In the field of television one of the most notable advances has been the introduction of mercury arcs to provide cool lighting on the television stage.

● Acetate Favored Abroad

The supply of raw materials for photographic manufacturing operations in this country was not cut off at the outbreak of hostilities in Europe in September as it had been in 1914. During the quarter century that had elapsed, sources of supply of several materials, such as gelatin, optical glass, sensitizing dyes, and certain developing agents, were built up in the U. S.

Motion picture film and the properties of its support from the standpoint of safety were discussed by Sulzer,[1] who dealt with the control of fire hazard in the production, distribution, and use of cellulose nitrate film. His report also treated the characteristics of cellulose acetate film in relation to this problem. Reports from abroad indicated that a gradual changeover to acetate film stock for 35-mm film appeared to be under way in Germany and France.

The year 1939 marked the fiftieth anniversary of the introduction of roll film by George Eastman and the sale of the first film by him to Thomas Edison with which the latter and W. K. L. Dickson prepared a short length of the first motion pictures. These were viewed with the aid of a peep-show device called the "Kinetoscope." The year also represented the hundredth anniversary of the first public announcement and demonstration of the Daguerreotype process.

One of the outstanding advances this past year has been the introduction of "coated" lenses in the camera to reduce reflection at the glass-air surfaces. The technics used by the two outstanding experimenters in this field, namely, C. H. Cartwright of M.I.T. and John Strong of Calif. I. G., are essentially similar and consist of depositing a transparent fluoride layer on the glass. For optimum performance this layer should be ¼ the wavelength of light.

A set of coated lenses has been in use at Paramount, and it is claimed that an *f*/2.3 lens, when so treated, becomes equivalent to an *f*/1.6, meanwhile retaining the depth of field, and the definition of *f*/2.3. Another way of stating this would be that the loss of light in an Astro "Pan-Tachar" lens, which is normally about 41 per cent, becomes negligible when such a lens is treated to reduce surface reflections. While the deposited film on each lens surface is only four millionths of an inch in thickness, the lens may be handled and even washed without removing this film.

Its iridescent magneta sheen, it is believed, will not interfere with color photography, as tests indicate no interference with either transmission or color correction. Undoubtedly, this improvement in the optical world, when fully perfected, will prove the outstanding and most progressive step of the year, presaging future advantages of inestimable value to an industry so wholly dependent on "little pieces of glass."

● Color Film Advances

In the field of color processes, Technicolor continued to dominate all other commercial production methods using 35-mm film. More pictures were made by this process than in any year heretofore. For example, nine Technicolor feature productions were in progress during the month of July. One of these, *Gulliver's Travels*, produced by Fleisher, represented the second feature-length cartoon ever made. The longest color motion picture ever produced, *Gone with the Wind*, was commented on very favorably for the beauty of its artistry and the quality of the color photography.

The Telco process for 35-mm film was stated to utilize bipack negatives from which black-and-white prints are made on both sides of duplitized positive film. The positive image is swollen during processing in proportion to the exposure gradation, and for that emulsion printed from the panchromatic negative, a red dye is introduced into the relief to fill the unswollen parts. After buffing and reswelling, a yellow

(*Continued on page* 27)

†J. Soc. Mot. Pict. Eng., XXXIV (May 1940).

1. Internat. Proj., **14** (April, 1939), p. 10.

Editorial

(*Continued from preceding page*)

menting which, it can be said that the modern sound reproducing systems now being offered for sale by the leading manufacturers will accommodate with ease any recording that will be offered generally to the trade by Hollywood for the next several years. Even the most attractive technical development must depend for its practical application upon ample financing, and dough is the one thing that the industry—all branches—has all too little at the moment, and, considering world conditions, likely will not have for several years.

All of which is not to imply that the stereophonic sound system is without merit. Quite the contrary is true. However, recognition must be given to the proven fact that the road leading to any general adoption of the system by the film industry is long and torturous and is beset by many pitfalls—ample indication of which is at hand in the frankly pessimistic statement anent the stereophonic system by its sponsors.

As for projectionists, our advice to them, as the only technically-informed person in and about theatres, is to assume their traditional role of being somebody more important than a mere employee by bringing this editorial to the attention of their theatre owners or managers and thereby saving the latter group much needless worry and probable loss of patronage by reason of continuing in service outmoded sound equipment due to any fear of the imminent introduction of stereophonic sound systems. Let the boss know that *you* know your stuff.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

FREQUENTLY motor generator sets transmit sound to various parts of the building by mechanical contact of the motor generator base with the floor. This transmission of undesirable sound by mechanical means may be eliminated by mounting the base on automobile valve springs.

One spring is placed under each foot of the base leaving the unit supported by the springs only. A bolt should be placed in the hole in the foot and held by a nut on the under side of the foot. This bolt prevents the spring from slipping too far out of line and should not be long enough to touch the floor.

A portion of any rigid conduit connected to the unit should be removed and replaced with flexible conduit or flexible wire loops.—E. D. CLIFTON, R.C.A., *Baltimore.*

• • •

A not infrequent cause of noise on belt-drive soundheads or motors is a very slightly loosened Allen or Bristow set screw on the motor pulley. The screw in question may not be loose enough to be detected by casual visual inspection, but it is loose enough to set up a serious vibration in the motor. The noise usually set up leads one to believe that the motor bearings are practically burned out. One-eighth to one-quarter turn of the set screw will usually correct this trouble.—K. P. HAYWOOD, R.C.A., *Baltimore.*

• • •

Test film loops can be stored away in small rolls without cracking at the bends which occur at the ends of the loops as follows: Cut the loop exactly in half and make two butt splices with Scotch tape. The loop can then be laid flat (a splice at each end) and rolled.

One had better make the loops long enough so that the click of the patch is less than the damping of the meter needle! —C. W. HILLIARD, *Altec, New York.*

• • •

The query is often raised why it is desirable to operate the tube which has the highest plate current of a push-pull stage in a particular socket of the push-pull stage. These kind of "whys" particularly worry Missouri-bred inspectors and projectionists and here's the answer, with specific reference to the W.E. 86 type Amplifier.

Second harmonics generated in the push-pull tubes reach the output of the amplifier in appreciable amount if the tubes are not perfectly balanced. The phase relation of this harmonic with respect to the fundamental may be shifted 180 by interchanging the tubes among the sockets. Second harmonic is also produced in the driver stage, and the phase of this voltage is not effected by the relative positions of the tubes. It is possible, therefore, to produce partial cancellation of these two second harmonic components by properly selecting the sockets for the two push-pull tubes. This has had adequate experimental demonstration. — ALTEC ENGINEERING DEPT.

• • •

Failure of adjustable type, wire-wound porcelain resistors used in exciter lamp supplies, motor starters, etc., generally occur at point where resistance wire is joined to end band. It is possible, by using other end of resistor and readjusting sliding contact the same distance from this new end as it was from the bad end, to restore circuit to normal.—G. P. KNAPP, R.C.A., *Atlanta.*

• • •

On some Columbia pictures there is a leader section comprising blank dark frames with nothing on them except 3 clear holes. This makes an ideal check for ghost travel in shutter settings. In some heads gear lash is such that when shutters are set with intermittents they still are out due to gear lash or play. This makes a much better check than titles on pictures. Incidentally, if ghost travel persists at all settings, shutter blades have been trimmed to increase light and are too small or narrow at point of light cut-off.—F. M. GOOKIN, R.C.A., *Boston.*

• • •

Within about seven months after new equipment was installed in one of my theatres six tubes were replaced in the first stage of the main amplifier because of low emission. On a hunch I checked the heater voltage and found it just on the lower limit. I changed the line tap on the power transformer to increase the heater voltage one volt and since then no more tube failures have occurred.

This demonstrates how important it is to frequently check heater voltages at all installations so as to take into consideration the power voltage coming into the theatre. It is common practice to accept as fact that this heater voltage is fixed in amplifiers which do not have readily adjustable facilities, such as in the old type amplifiers which used d.c. tubes and were provided with adjustable rheostats in the filament circuit.—F. J. HOMSHER, *Altec, Philadelphia.*

• • •

On April 6 Field Engineer Barbier received an emergency call from a theatre in his circuit, reporting loss of sound after a bolt of lightning hit nearby the theatre. Upon inspection a bleeder resistor in the amplifier was found open and the case of the power transformer which is mounted near the resistor was discolored from the flash.

On April 28 Field Engineer Barbier received an emergency call from another theatre equipped with a similar system. The exhibitor reported the sound went dead during an electrical storm. Upon inspection the bleeder resistor was found open in the same spot as at the previous theatre and the transformer case had the same tell-tale discolored markings.

To complete the story, both amplifiers were hit the same hour of the day. The lightning did not strike in the same place in Texas but did hit the same spot in two similar amplifiers. — J. O. HILL, R.C.A. Service Manager, *Dallas.*

• • •

Here is a quick test to determine whether a condenser is open. Momentarily connect a condenser in series with the 25-volt lamp and 110 volts. Unless the condenser is open, the lamp will light about half brilliancy on capacities of .5 mfds and above, and on smaller capacities the light will either glimmer or a slight spark can be seen when contact is made and broken.

Testing for shorted condensers is easy, whereas checking for open condensers is often difficult. I have found the aforementioned simple test to answer all the requirements for quick projection room work and already have passed it along to a number of other inspectors who use it today.—W. V. HOWARD, *Altec, New York.*

• • •

Several of the boys advise that their watches have been tied up in knots by

the permanent magnets of loudspeaker telephone units. When you take your watch to a jeweler for demagnetization, which you will probably have to do sooner or later, have the jeweler first put a compass on top of it and watch what happens to it—the compass will go around and around like a motor.

In fact, the other day I was working backstage and had my pliers in my hip pocket. I bent over to check something and backed up against the baffle and, believe it or not, my pliers came right out of my pocket and stuck flat against the baffle, held tight by the permanent magnet fields. I've got witnesses to prove it.—W. V. Howard, *Altec, New York.*

• • •

S. H. Schultz, RCA Engineer in Washington, D. C., is the proud daddy of Robert Edward born April 8, 1940.

B. & L. New Cinephor f: 2. Lens Series

PROJECTION lenses by Bausch & Lomb is as old as the motion picture industry itself. The professional showing of the first commercial motion pictures with Edison's Kinetoscope was made possible with B. & L. projection lenses.

Rapid developments in a fast-growing industry brought about a need for standardization with a resulting adoption of the present so-called 35 mm. film. Paralleling these developments, and to make possible the projection of the new film standard, B. & L. introduced the motion picture lens tube which for years was standard equipment on the professional motion picture projectors of that period.

The early '20's again saw a period of rapid development in equipment and the introduction of the Cinephor series of lenses. During the succeeding years, the Cinephor set a standard for quality and supplied the answer to an ever critical growing industry. The standard of quality set by Cinephor lenses was excelled only by the Super Cinephor series, the first anastigmat ever offered for projection purposes.

● Original Cinephor Series

The original Super Cinephor series was developed to fulfill the rigorous requirements of projecting wide film. When wide film proved to be little more than an idea, Super Cinephors went on to become the standard of projection lens quality.

Although the Super Cinephor lenses were made in a higher relative aperture than any lenses previously offered, the gain in light transmission resulting therefrom was offset by the effect of their more complex construction. The net result, therefore, was lenses of excellent imaging characteristics but lacking the light transmitting qualities of the less complex Cinephor series.

With an increasing number of motion pictures being made in color, the need for more illumination without sacrifice of optical correction has been very apparent.

Again, to satisfy the needs of the industry. B. & L. offers a completely redesigned series of Super Cinephor, retaining the excellent image-forming qualities of the original series and matching these with illumination characteristics to satisfy the most critical requirement.

These illumination characteristics have been made possible by increasing the relative aperture of the Super Cinephor series to *f*:2.0, the use of optical glasses developed in B. & L.'s own glass plant with better transmitting characteristics, and the commercializing of a process known for some time of treating glass surfaces to reduce light losses at those surfaces.

● Super Cinephor f:2

Super Cinephor lenses have always been outstanding for their excellent covering qualities, crisp definition, and unusual correction for spherical and chromatic aberration, regardless of focal length. These outstanding characteristics have been carried over into the completely redesigned new series of Super Cinephor, but in addition, this new series of lenses has light-transmitting qualities not heretofore found in projection lenses.

This improvement has been accomplished by designing this series with a larger relative aperture, *f*:2 as compared with *f*:2.3, by employing glasses which have better light-transmitting qualities than the same types of glasses heretofore available. and being the first to commercialize known processes of treating lens surfaces to reduce reflection losses. These factors not only account for almost unbelievable gains in illumination, but the resulting contrast in the projected image, whether color or black-and-white, is second only to the gain in illumination.

An innovation in the construction of projection lenses employed for the first time and incorporated in the Super Cinephor series is the sealing of the lens at all points to prevent foreign material entering the lens, thereby eliminating the need for cleaning of other than the two exposed outer surfaces. This assures that the lens is working at maximum efficiency at all times. Since it is not necessary to take the Super Cinephor *f*:2 apart for cleaning, there is no danger of damage to lens surfaces or lens elements.

The Super Cinephor is available in focal lengths of 2″ to 5″, in ¼″ steps. The first four focal lengths are mounted in the No. 1 size of barrel, whereas focal lengths from 3″ to 5″, inclusive, are mounted in a No. 2 size of barrel. The 5″ focus *f*:2 lens is the longest focus *f*:2 lens that can be mounted in a No. 2 size of barrel.

The need for the Super Cinephor type of construction decreases with the increase in focal length. Consequently, since it is not possible for current day projectors to accommodate lenses if mounted in larger barrels, the Series II Cinephor is offered in the longer focal lengths outside the range of the Super Cinephor.

The Super Cinephor lenses are readily adaptable to currently manufactured projectors with adapters included with each lens. To adopt these to discontinued projectors, special holders are needed which are available from the distributors of the projector manufacturer.

Many requirements demand lenses of longer focal length than is available in the *f*:2 series. For this requirement, the Cinephor Series II will be continued in an improved form. In the future, this series of lens will be offered only with treated surfaces, thereby increasing their transmission approximately 15 per cent, with a resulting improvement in contrast. As in the case of the Super Cinephor lenses, this series is sealed.

This series is available in focal lengths from 5″ to 9″, inclusive. All lenses are mounted in a No. 2 barrel. Adapters are available for all projectors.

The *f*:2 Cinephors make up an entirely new series of projection lenses and are offered in the popular range of focal lengths from 3.50″ to 5.00″, inclusive. The speed of *f*:2 is maintained throughout the series. While not possessing the qualities of the Super Cinephor, they give excellent imagery along with super illumination characteristics as compared with the Cinephor Series I lenses.

All focal lengths are mounted in the No. 2 size of barrel. This is a popular priced series that is offered without lens surfaces treated. for those desiring good imagery and high speed. This series is adaptable to currently manufactured projectors.

The Cinephor Series I lens has been very popular in the past as a low priced lens for use on portable or semi-portable equipment. and to some extent for theatre use. This series. therefore. will be continued as in the past.

The New GL-4 (Hall) High-Intensity Arc Lamp Now Ready

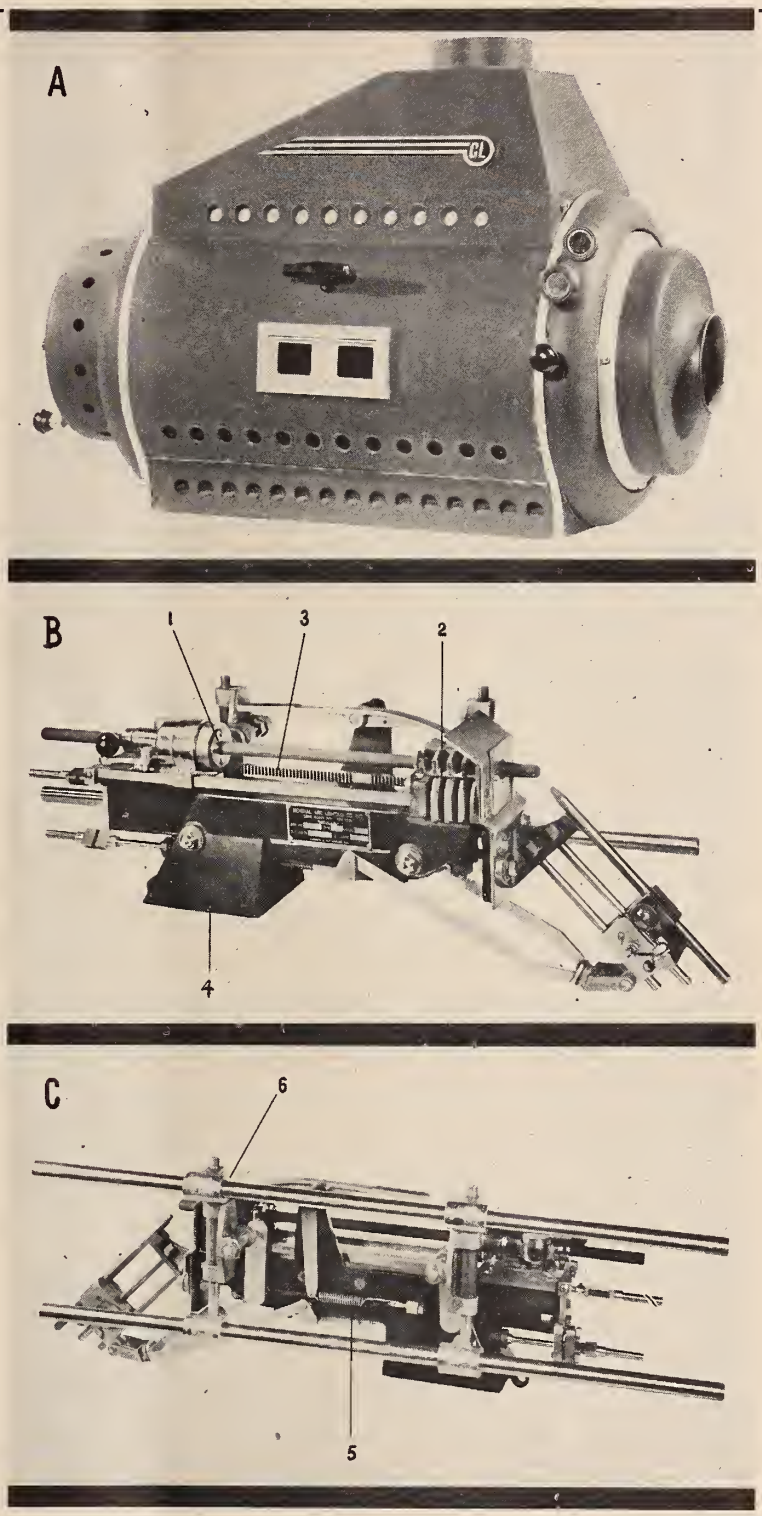
MARKING the first activity in the high-amperage high-intensity lamp field in several years is the introduction of the new GL-4 model of this type by the General Arc Lighting Co. of Long Island City, N. Y. This new lamp was designed and its construction supervised by Mr. Theodore Hall, who will be remembered for the series of high-intensity lamps which he engineered for the old Hall & Connolly Co., and the job reflects his long experience in the high-amperage arc field.

Incorporated into the design of this new GL-4 lamp are the fruits of long and intensive experience gained by General Arc Lighting in the building of both army and navy searchlights for various countries, including the United States. The accompanying illustration shows graphically the general overall appearance of the lamp and some of its details, supplementing which is the following technical data.

The positive carbon is automatically and positively gripped in an improved carbon holder, which in turn is mounted on a sliding carriage which is guided on accurate and sturdy tracks for the steady, even and accurate advancement and rotation of the carbon through the positive carbon shoes. No rollers, worms, or other uncertain means are utilized for the movement of the carbon. The travel path of the positive carriage is extra-long, and no tools are required for the disengagement and resetting of the holder on the carbon.

An applied extra-heavy air pressure provides forced ventilation of the positive contacts, which, incidentally, are made of the most modern metal which is noted for its high electrical conductivity and heat dissipation.

The GL-4 lamp embodies more exact and stable methods for mounting condenser lenses, and more convenient and accurate means for focusing the light on the aperture. One of the outstanding features of this lamp is the photoelectric means employed for maintaining the tip of the positive carbon exactly at the focus of the condensers. This device is sealed in a very small case as part of the burner frame, does not require adjustments, and may be switched off thus enabling operation of the lamp on the motor feed control in the conventional manner. The GL-4 amperage range is from 120 to 180, with 13.6 mm. carbons, either regular or super-high, being used.



THREE VIEWS OF NEW GL-4 (HALL) H-I ARC LAMP

A—General overall view of lamphouse. B—Side view of burner, showing component units. C—Underside view of burner.

Legend for numerals: 1. Self-gripping positive carbon holder. No screwdriver required for tightening carbon. 2. Solid shoe-type contacts. 3. Rack-feeding positive carbon unit. No worms utilized. 4. Forced ventilation of positive contacts, including main frame of lamp. 5. Adjustable positive contact tension spring. 6. Burner lineup adjusting screws. Once the burner is lined up it is locked permanently in place, eliminating outside focusing handles, etc.

Radio Pickup Interference A Serious Sound-Film Servicing Problem

A SERVICE inspector must be good, these days, if he is to successfully deal with the many unusual problems which crop up on almost every service call. Among other things, he must be a first-class radio detective. For proof of these statements, glance over the following several instances which have been taken from emergency call reports turned in by Altec inspectors.

First, a knowledge of the Morse code is a big help. Inspector C. W. Hilliard answered a trouble call over in Jersey City from a theatre which reported, "radio signals being picked up by the sound system and reproduced in the theatre." When the sound system finally reproduced the call letters, Hilliard knew just what to do and was able to trace the interference to an amateur transmitter in a rooming house a short distance away.

The offending radio transmitter may be either far or near. Last month, Inspector J. A. Darrow answered a trouble call in upper New York and found that the microphone attachment was picking up signals transmitted from an amateur antenna which was strung directly over the projection room. To the other extreme, about a year ago Altec recorded its prize long distance radio pickup trouble: By deciphering the station's call letters, Inspector Max Neumann determined that the signals being picked up in a Los Angeles theatre were coming from an amateur transmitter in the fifth radio district—at least 800 miles away!

This distance may seem fantastic, but it must be remembered that the modern theatre sound system is capable of tremendous amplification and many of its circuits are similar to those of a radio receiver. With the proper combination of circumstances, the sensitive amplifying system will pick up, both detect and amplify, one of the thousands of faint radio waves which are constantly bombarding it.

Radio interference often results in reproducing extraordinary movie sequences. For instance, "The Star Spangled Banner" showed up faintly, but distinctly audible to the entire audience in a comparatively silent scene of the feature "Raffles" being played at Harrisburg, Pa.

But the strangest of all cases of "crossed wires" occurred several months ago in Virginia, Minn., and was reported on the first page of the *Virginia Enterprise*, local newspaper, as follows:

"WAIT A MINUTE, JOE!"

Henry Fonda was just about to bestow a kiss on fair Claudette Colbert Sunday night on the Maco screen when suddenly a voice that surely was not Henry's boomed:

"Wait a minute, Joe, there's something wrong here—there's a screw loose." The audience roared.

Just a few minutes before, as Indians were sneaking over the hills to the low rumble of Drums Along the Mohawk, the startling crackle of a modern short-wave station intruded on the scene. It was phenomenal, both from the standpoint of early American warfare and modern movies.

The projectionist turned into a frantic human, searching wildly for a possible loose connection to the amplification system. H. E. Billings, theatre manager, shouted something like, "Call the police, call the marines, call the navy, call somebody," and then, settling for police, called them. Police contacted short-wave stations.

Today, a serviceman, going over equipment, blamed the modern version of "Drums Along the Mohawk" on atmospheric conditions.

The cause of the trouble expressed in the newspaper article was apparently the editor's own version. Altec Inspector Pond located a short-wave amateur station as being the seat of the troubles. Mr. Pond being a "ham" operator in his own name was well qualified to advise the amateur how to properly neutralize his set and install r.f. chokes so as to prevent any further scrambling of the local theatre's program.

The elimination of radio signal pickup in theatre sound systems is often the toughest job the service inspector has to tackle. The pickup may be subject to a limitless combination of conditions, and the correction is often just as difficult to devise. Sometimes, adding grounds to various parts will work wonders; in other cases by-pass condensers connected to power supplies and in grid circuits will do the job; or it may be necessary to design critically adjusted wave traps into certain parts of the circuit.

Often the pickup comes in over the power lines. In Providence, R. I., the other day, Inspector A. W. Hyde found out that intermittent radio pickup on the p.a. system was due entirely to a broken shield on one of the microphone cables.

There are other angles to this radio interference trouble. Sometimes the interference goes the other way, that is, nearby radio receivers pick up interference from theatre equipment. Such was the case encountered by Altecman H. A. Swim out in Blackwell, Okla. The manager reported that a tenant in the theatre building was complaining that his radio was picking up projection equipment noise. Swim found that the source of the trouble was the commutator of the arc generator, and cleared the trouble by shunting the generator armature by a fused condenser of large capacity.

Inspector Case of Newark reports this one: "Interference was experienced from WJZ's carrier at Bernardsville, N. J. After a check up, it was found that the trouble appeared only when a neighboring candy store had their small radio going. The interfering signal was being rebroadcast from the receiver. All conduits were banded to ground and fittings and nuts tightened, which corrected the trouble."

Difficult to Digest

And now from the humorous side. Inspector C. E. Maass answered a call for help regarding radio music in a Hartford, Conn., theatre. The theatre was located about 100 feet from Station WTHT from which Maass had previously had trouble with pickup and had corrected by judicious application of de-tuning condensers. So, first he checked to see whether his de-tuning condensers had gone "West," but no, they were O.K. Investigating thoroughly, Maass wound up by reporting laconically: "The trouble located was a patron sitting in the theatre with a portable radio turned on. Elimination of the patron and his portable radio corrected the trouble." — ALTEC ENGINEERING DEPT.

[ED.'s NOTE: *Aforementioned superfluity of sound reproduction stretches credence to within a mil of the breaking point, but it still makes for a good yarn, and its author should have no difficulty in qualifying for membership in the Ananias Club.*]

A. M. BEATTY, IPC, DIES

Albert M. Beatty, until his retirement two years ago head of the Camera Department of International Projector Corp., died in his home in Nutley, New Jersey, recently after a long illness. Born in Kansas City in 1884, he eventually became connected with the film industry and took "Birth of a Nation" through South America for D. W. Griffith.

During the first World War Beatty reorganized the theatrical department of the Y.M.C.A. in France, and was so successful in this he was placed in charge of all theatrical entertainment for the A.E.F., in which capacity he directed the appearances of many of the foremost stars of that period. He was a pioneer and firm believer in the ultimate importance of 16 mm. reproduction. Beatty joined International in 1928, remaining until his retirement in 1938 due to ill health.

Paramount has signed a revised license agreement with ERPI for recording and distribution of Par pictures. The terms of this agreement are identical with those of the agreement recently signed by Loew's, Inc.

SMPE PROGRESS REPORT FEATURES OPTICS, 16MM. SPURT

(*Continued from page* 22)

dyed gelatin layer is applied. The process is repeated on the opposite side of the ortho negative where blue and green-dyed layers are used.

Expansion of facilities was announced for two bipack processes, Cinemacolor and Magnacolor. A new plant with a stated capacity of one million feet of two-color prints each week was opened by Cinecolor in Burbank, Calif., in March, 1939. Interest was developed in the monopack triple emulsion processes, Kodachrome and Agfacolor, although to date these have been used only for still photography.

● 16-mm Scores Wide Gains

Present trends in the substandard motion picture field make it possible now to classify this phase of the industry into two groups: the 16-mm or semi-professional, and the strictly amateur 8-mm group.

Continual improvements in film quality, combined with better and more powerful projection equipment, now make it possible to exhibit 16-mm productions successfully before large audiences. This, together with the generally lower production cost of 16-mm productions, has been instrumental in supplanting 35-mm film in many fields in which it, before the advent of these improvements in 16-mm film, found exclusive use. Sixteen-mm equipment is, in general, smaller and more flexible than 35-mm equipment.

During the last year manufacturers, awakening to the possibilities offered by this recording medium, have striven to develop 16-mm films, cameras, projectors, and accessories which would provide the same facilities that heretofore have been available only to the professional user of 35-mm film. In this they have been eminently successful, and today users of 16-mm films have at their disposal equipment capable of delivering results favorably comparable to 35-mm productions.

A new preview attachment (*MI*-1075) was introduced by R.C.A. It consists of a single lower magazine for a 35-mm theatre type projector. The new magazine accommodates three 1000-ft. reels for use when the sound and picture are simultaneously reproduced from separate films. For normal projection of a composite print, space is provided for a 2000-ft. reel.

The year 1939 again demonstrated the worth of the Simplex *E*-7 projector mechanism, first marketed during 1938. The introduction of dual shutters operating on the same shaft has made practical, through optical inversion, a total reduction in shutter blade area of 40 degrees, thereby appreciably increasing the picture brilliancy with a given light-source.

Other important features include: removable fire-trap; "one-shot" pressure oiling system completely filtered to prevent foreign matter from getting to the bearings through the lubricating system; automatic locking of the gate in either the



A Superficial Reason Could Not Explain It

The intelligent cooperation which the Altec service man receives from the projectionist, and the equally intelligent cooperation which the projectionist receives from the Altec man, are the result of no superficial circumstances. Such cooperation is based on a *fact,* a common-sense fact recognized by both. Both the projectionist and the Altec man do their essential part in keeping the equipment functioning at top-flight efficiency. Naturally, each knows how much the other contributes to keep it that way.

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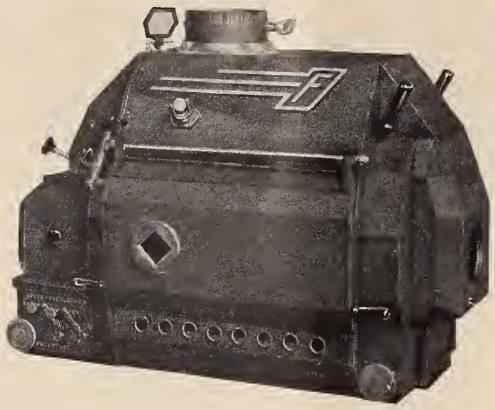
THE SERVICE ORGANIZATION OF THE MOTION PICTURE INDUSTRY

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FOREST

'Universal Trim'

LAMPS



. . . . IT'S NOW UP TO YOU—

to take advantage of our engineering achievement. No more 'LIGHT, OPERATING, AMPERAGE or COST' worries because FOREST 'UNIVERSAL TRIM' LAMPS take any carbon trim. Engineered mechanical improvements are not limited to any amperage—but will operate from 30 to 65 amperes at lower operating cost and at a higher efficiency rating.

1 FOREST 'UT' LAMP HAS ALL THESE THINGS

ENGINEERED FLEXIBILITY

6 to 13 mm. POSITIVE

5 to 9 mm. NEGATIVE

A few simple adjustments is all that is necessary to switch from Suprex-Simplified H-I, Intermediate H-I (1 Kilowatt Arc) or Low Intensity. THIS IS 'UNIVERSAL TRIM'.

Separate POSITIVE Feed Mechanism

Separate NEGATIVE Feed Mechanism

MANUAL FEED DOES NOT INTERFERE WITH ELECTRICAL CONTROLS

Accurate, independent adjustment of either carbon without affecting the feeding speed of the other. This keeps the arc in exact focus with the optical system at all times.

RESERVE POWER

30 to 65 AMPERES

Regardless of the arc intensity used, 'just step it up' if a little more amperage is needed. You are not limited to a 40-ampere maximum.

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OUR BROCHURE—'FACTS and FEATURES'—is just off the press . . . send for your copy today and learn why you'll switch to FOREST 'UNIVERSAL TRIM' LAMPS in preference to any other arc light system. Don't BUY any projection arc lamp unless you have seen the Lamp that does what all other lamps claim to do—COMBINED.

FOREST MANUFACTURING CORPORATION

200 MT. PLEASANT AVE., NEWARK, N. J.

open or closed positions; convenient means for adjusting the film tension; and improved intermittent movement and sprocket, hardened and ground to such precision as greatly to reduce the movement of the picture at the aperture.

Simplex 4-Star Sound Systems

The Simplex 4-Star sound system, introduced during 1938, continued to be very popular with exhibitors during 1939. Most prominent among its design features are the ease of servicing, facilities for accurate adjustments, and the stability of its operating characteristics. Other innovations, such as the extensive use of feedback, and the reduction in the number of transformer-coupled circuits, resulted in a pronounced improvement in the matter of both amplitude and phase distortion. Pioneered in this country was the use of permanent magnet loud speakers.

During 1939 International Projector Corp. introduced a completely new projection and sound equipment for the smaller theatre. The Simplex *SI* projector, together with a new low-cost pedestal of the rectangular box type and two lamp houses known as the Simplex Low and Simplex High, provide an attractive line of quality apparatus for a very large market.

Simultaneously with this came the Type *E* 4-Star sound system which was designed to provide the same grade of high-quality reproduction for the smaller theatres as has been available in the past only to the larger houses. This system furnishes exactly the same sound head as is used in all of the other Simplex 4-Star systems. In addition, the identical type of permanent-magnet loud speaker units are used and the circuit features are fundamentally the same. The cost reduction of this system was primarily obtained through the use of a.c. for energizing the exciter lamp, one common volume control amplifier instead of individual ones for each machine, cabinet and mounting arrangements, and the use of smaller multicellular high-frequency horns made possible by an 800-cycle dividing network.

A new inexpensive brightness meter known as the Luckiesh-Holladay meter has recently been made commercially available by G. E. This covers a range of from 1/100 of a foot-lambert to 75,000 foot-lamberts, and employs the familiar concentric spot field, part of the field being the object whose brightness is measured, and part by a small battery-operated lamp whose brightness is adjusted by means of a photocell-operated light-meter. It has already proved to be a useful instrument for motion picture screen brightness measurements as well as for general brightness surveys in the theatre.

Coated Projection Lenses

The application of a non-reflecting coating surface to projection lenses similar to that discussed previously for camera lenses has been discussed by Prof. C. H. Cartwright of M.I.T. Demonstration showed the difference between the new film-treated lens and a standard projection lens. Two matched films of the same subject were projected simultaneously upon a single screen by two projectors, one equipped with a treated lens and the other with an untreated lens. Half of the film was masked in each projector and the halves matched on the screen, allowing visual comparison of the light-transmission of the two lenses.

Regular television service to the metropolitan N. Y. area from a transmitter on the Empire State Building was inaugurated on an experimental basis on April 30,

1939, with fanfare coincident with the opening of the New York World's Fair. At about the same time television receivers by a number of manufacturers were offered for sale in the New York area. Transmissions have averaged approximately eleven hours per week of entertainment features plus a somewhat greater number of hours of test-pattern signals.

Programs picked up at points remote from the studio have become so popular that a new type portable equipment in suitcase form has been developed, manufactured, and put into service in the N. Y. and Los Angeles areas. Some of the cameras for this service use a small Iconoscope to make possible a small and light unit. A number of simplified television studio systems were built and used at fairs and exhibitions. It was found practicable to use short lengths of selected regular telephone circuits for the transmission from the remote point to the transmitter.

Two reports dealing with problems in television broadcasting were issued by the television committee of the F.C.C.

A beginning was made in industry cooperation toward reduction of various types of interference to television and other ultra-high-frequency services. Research continued on apparatus for large screen television and a number of showings were made to indicate status and progress.

Three Type *H*-6 water-cooled lamps were used to light the television studio in the G. E. exhibit. Two incandescent spots, with heat-absorbing glass filters, were added to improve the appearance.

Early in June, G. E.'s experimental television studio at Schenectady began operation. For lighting the area in which the action occurs, twelve Type *H*-6 water-cooled lamps, arranged three to a reflector, are being used. The purpose of putting three lamps in a single reflector is to minimize the effect of the cyclic variation of the light, each lamp being placed on the leg of a three-phase circuit. This installation is capable of providing 1000 to 1200 foot-candles over an area 12 x 12 feet.

Two New Academy Reels For Sound Quality Tests

The Research Council of the Academy of M. P. Arts & Sciences announced recently the availability of two additional test reels for use in adjusting and maintaining theatre sound reproducing equipment to current quality standards: a Standard Flutter Test Negative for measuring the amount of flutter in a theatre soundhead and a Standard Continuous Scanning Illumination track for rapidly and accurately measuring the uniformity of illumination across the scanning slit in a sound system.

The Continuous Scanning Illumination Test Track has been prepared to give a rapid and accurate method for measuring the uniformity of illumination across the scanning slit. It consists of a print approximately 8 ft. in length to be made into a loop for measurement purposes.

A 100-cycle variable-area track with an amplitude of 7 mils is placed on the film in such a way that the track, beginning at the splice, is at one edge of the scanning slit and moves progressively across the 84-mil slit until at the end of the 8-ft. length of film the track is on the opposite side of the scanning slit. Thus, if the illumination across the scanning slit is constant, the output from this track as measured on a V.I. meter will



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be constant. If the illumination varies, the amount of this variation may be read directly on the V.I. meter measuring the output. The maximum allowable variation in output level is ± 1½ db.

Urge Use of Butt-End Splice

In order to maintain a constant length of track and thus hold the scanned area constant, the usual type of film splice should not be used in making up this loop. Instead, a butt-end splice should be employed, secured by placing the ends of the print securely against one another without any over-lap and joining the two ends with transparent tape, such as Scotch cellophane tape. Experience has shown this splice to be very practicable as it may be remade without any loss of film. In addition this type of splice disturbs the reading of the V.I. meter less than the conventional over-lap splice.

This film is not intended for use to determine slit placement adjustment, for which the buzz track should be used. Code number is AST8-1. Price for an 8-ft. loop is 50 cents postpaid. A 10 per cent reduction is allowed on orders for ten or more.

The Flutter Test Negative film has been prepared for measuring the amount of flutter present in a sound head. This track is a 3000-cycle, variable density negative, carefully recorded so that startting in the band from 0 to 1 cycle, each individual band contains only a small percentage of the total flutter content of 0.05 per cent. A complete analysis of the flutter content of this negative will be furnished with each order of film.

Code number is A3KC-1. Price is 5 cents per foot in minimum lengths of 50 feet, f.o.b. Hollywood.

RCA SOUND SYSTEM BOOK FOR PROJECTIONISTS

The principles of motion picture sound and sound equipment are explained in detail in simplified language in a 68-page handbook for projectionists prepared by RCA Photophone, which is being distributed by RCA servicemen. The book is profusely illustrated and includes functional circuit diagrams for each RCA system. It is dedicated to the projectionists, "who have the major responsibility for the proper presentation of sound motion pictures to the public."

The book opens with a simplified explanation of the nature of sound, how it is created, carried and heard, a discussion of music and musical chords, and the overtone ranges in music. It then proceeds to discuss 35 mm. film and sound recording, various types of recordings, recording optical systems, ground noise reduction and ultra-violet light recording. Much space is given to the influence of sound on the dramatic value of pictures, and the requirements, as to equipment and theatre acoustics, for good sound reproduction.

Each of the nine RCA Photophone sound systems is described in detail, with diagrams and photographs. Other topics follow in order: requirements for good picture projection, push-pull soundhead, portable emergency sound system, RCA Photophone Trans-Lux system, service, test equipment, special test equipment, and the RCA television system. The concluding pages are given over to technical definitions, television terms, decibel charts, and a projection chart.

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Construction of a new factory has been started by G-M Laboratories, Inc., of Chicago, to provide larger manufacturing and research facilities for its widely diversified line of products. The new plant, on the N.W. side of Chicago will be a modern, one-story building. Walls will be 90% window space.

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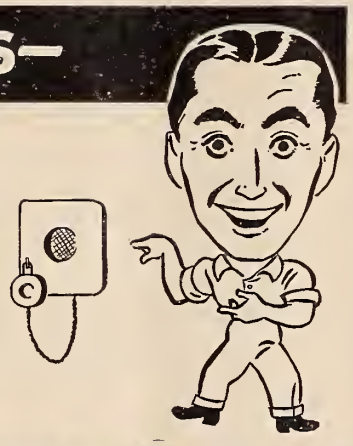
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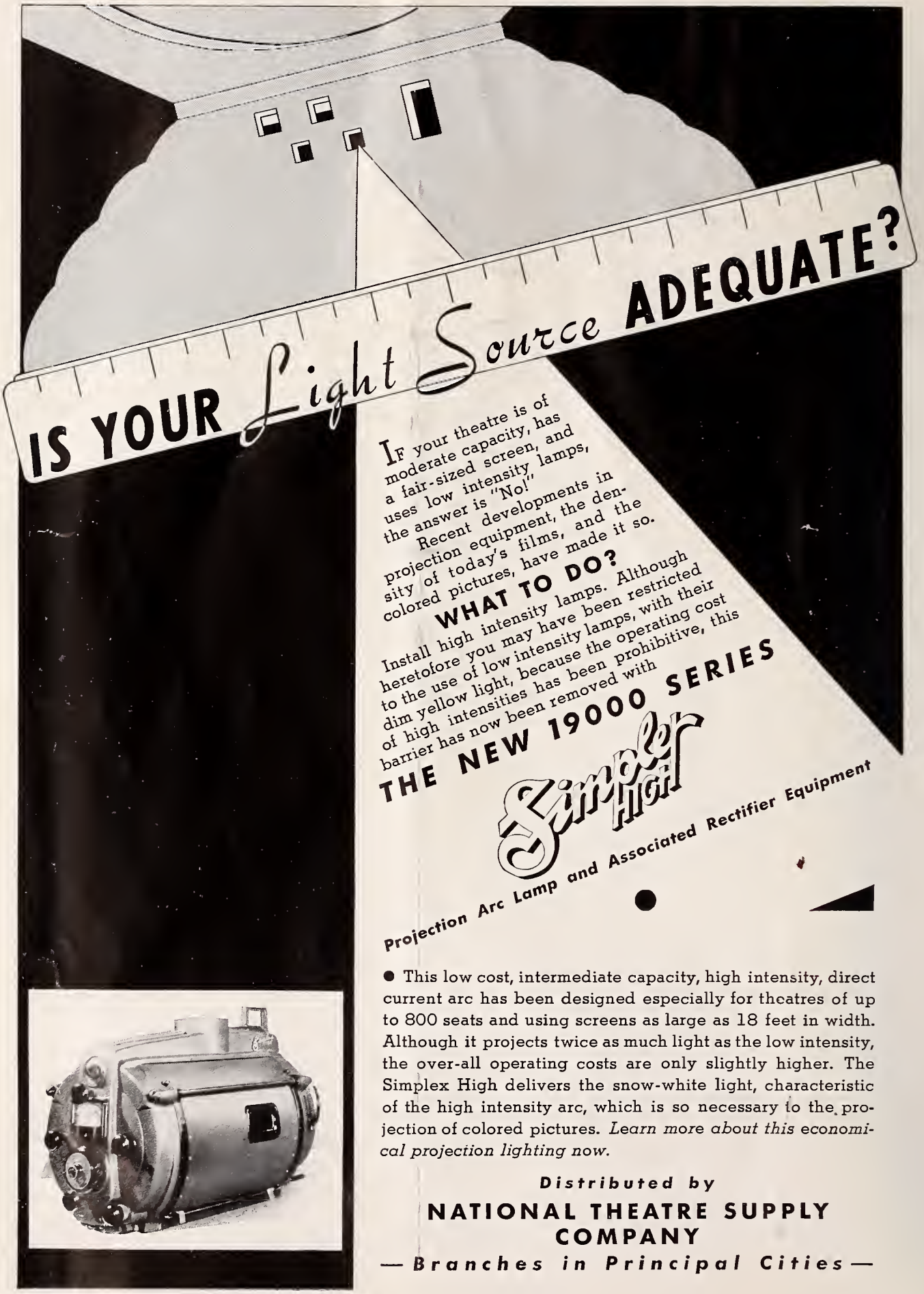
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JUNE 1940

VOLUME 15 • NUMBER 6

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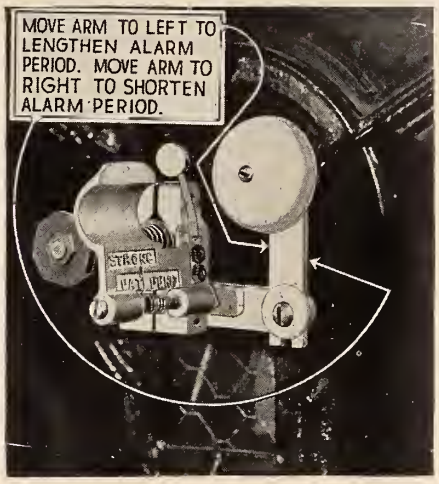
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Edited by James J. Finn

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Monthly Chat

MUCH very silly comment is making the rounds anent the efficiency of the new coated lenses. Increases of the order from 35 to 50 per cent are mentioned by those who should know better, and without any basis for comparison. A real boost in efficiency is noticeable by comparison with the Cinephor lens; but this figure slumps sharply when the new lens is compared with the Super Cinephor. Discussion incident to Dr. Rayton's (B. & L.) recent paper on this topic at the last S.M.P.E. meeting clarifies many important aspects of this matter. In our next issue.

• • •

Manufacturers of projection equipment failed to display their wares at the recent I. A. Convention in Louisville; yet an exhibitor gathering in Chicago a couple weeks later saw these companies falling over one another in an effort to "sell" the fine points of their equipments to people who don't know the difference between a photoelectric cell and a sprocket. Funny business, this.

• • •

Those who pooh-pooh television as an immediate threat to the picture business should get a load of current tele broadcasts, even on the present small 9 x 12 inch screens. Good lighting, nice detail and excellent continuity mark these offerings. I. A.'s special committee to look into this matter was formed none too soon.

• • •

The Academy Research Council is doing a fine job of coordinating studio and theatre activities looking toward improved screen results. However, nothing seems to happen in connection with print density, the same scenes on different reels exhibiting a contrast as marked as that between night and day. Even the most unbalanced projector combination couldnt give such poor results.

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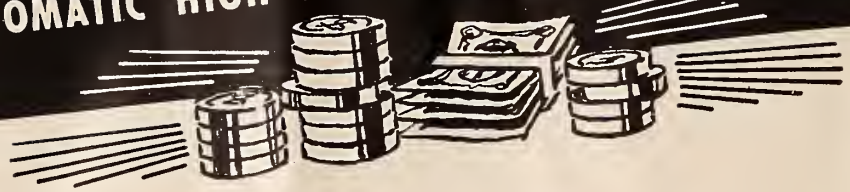
What will happen to the Phillips factory in Eindhoven, Holland, universally recognized as the foremost research outfit in the world, now that the Nazis have taken over? The Phillips representative in America sat in this office only three months ago telling us about all the marvelous things they were working on for the motion picture and the radio fields, with special emphasis on mercury vapor light sources.

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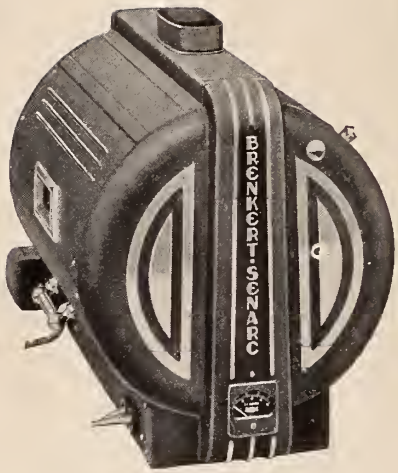
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VOLUME XV JUNE 1940 NUMBER 6

Sound Reenforcing System Data

By *PAUL P. MELROY*
PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

ANY system which projects sound so as to increase its loudness within a required area may be classed as a sound reenforcing system. The necessity for increasing loudness may be due to the normal decay of sound as it travels from its source to the required area, or to other sounds setting up an interfering noise level.

In the theatrical world, where speakers' and singers' voices during stage presentations must be projected with proper loudness to each listener, it is a problem of space rather than an interfering high noise level. Designers of existing large theatre auditoriums found the problem of making possible good hearing enjoyment of sounds originating on the stage a very acute one.

Of the many systems used to reenforce sound, the present highly developed amplifier using electronic vacuum tubes, combined with microphones, loudspeakers, and suitable controls, has doubtlessly given the greatest assistance in making possible the success of the present-day theatre. However, this particular type was not known years ago when the famed Greek and Roman theatres enjoyed universal popularity. History reveals some interesting facts about sound in those very early theatres.

The first open-air type auditorium consisted of a flat open space where speaker and listeners were on the same level plane. This was soon changed by elevating the speaker's platform, later followed by elevating succeeding rows of seats so as to form a semi-circular bowl with the stage in the center of the hollow.

Although the absence of surrounding walls and ceiling gave freedom from echoes and reverberation, there was a definite lack of sufficient sound intensity to the more remote listeners, as the speaker's voice did not have the necessary delivery power. This fact is evidenced by the bowl-shaped circular seating arrangement where all listeners were placed as closely as possible to the stage, and the peculiar shaped face masks, which simulated a crude megaphone, worn by the early theatrical players. There is also evidence of the use of large bronze circular vessels, urns, *etc.*, peculiarly shaped into resonators, which were scattered throughout the theatre. These were tuned to various audio frequencies so as to emphasize important frequency components of speech and with special effectiveness to music.

● Acoustic Considerations

Then came the first realization that sound could be reflected so as to increase its intensity at a desired point, and the first sound reenforcing system was devised. Sound boards, with straight and curved surfaces, were erected above the stage to reenforce the direct sound to the listeners.

As the success of the theatres spread to other countries where climatic conditions prevented open air productions, enclosed edifices were built. It was found that the addition of walls and ceilings to space caused reflection of sound back to the listeners, which sound would normally have been lost into free open space. In addition, the enclosure produced delayed reflections which enhanced the tone and richness of music.

Although these reflections were beneficial in increasing the intensity of sound, it was noted that these reflections had to be controlled—otherwise confusion resulted from excessive echo and reverberation. Sound absorbing material was needed. Extremely large auditoriums, luxuriously built of stone and polished marble, had deplorable acoustical properties. An example was the famous Milan Cathedral, Italy, with a volume of about 7,000,000 cubic feet, where a musical chord from the powerful organ would persist about 8 seconds, and the words of the priest resulted in a great confusion of un-intelligible sounds.

Scientists and acoustical experts worked tirelessly in their efforts to derive laws governing reverberation time, size and shape of auditoriums, and sound absorption of materials, which are now used by architects to attain such a high degree of success in great auditoriums of recent date.

Although the topic at hand is sound reenforcing systems, the preceeding brief review is important because of the manner in which sound is affected by acoustical conditions. The very best

sound system available, carefully arranged, may perform poorly in enclosures with inferior acoustical properties. Conversely, a poor sound system, haphazardly installed, may give passable results in a well designed and properly sound treated auditorium.

Certain modifications to the electrical circuits and special placement of microphone and loudspeakers can be made to help overcome acoustical difficulties, but the final results under such conditions will never be as satisfactory as with the equipment installed in a standard manner and appropriate measures taken to correct acoustical conditions. Therefore, it is very obvious that the acoustical properties of any auditorium or enclosure must be considered in the final analysis of the success of any sound reenforcing system to be installed therein.

● System Requirements

The essential requirements of such a sound system are that it must pick up all desired sounds and project them, unaltered, with sufficient intensity and distribution to all listeners within a given area. For maximum effectiveness, the system must function so as not to detract the attention of the listeners from the sound source. If the audience is not aware that a reenforcing system is in use, and yet completely enjoys the clear articulation of speech and the natural tone of music, then the system is operating at maximum efficiency. Such accomplishment appears to be simple, but it can be done only by equipment carefully selected to meet conditions pertinent to each particular job.

The type sound to be picked up, either speech or music or both, and the pickup area, as well as the possible desire to conceal the pickup devices, determine the type and number of microphones to be used. The required overall gain of the sound amplifiers is based on the type microphone selected, the pickup area, the attenuation of a mixer (if used), and the desired power output level. The power output of the amplifier is determined from the seating capacity and the cubical volume of the auditorium.

The type, number, and location of loudspeakers for sound projection and distribution are based on the seating arrangement and distance to the most remote listener. The preservance of good illusion cannot be overlooked in placing loudspeakers. The necessity for a mixer hinges on the number of microphones required, the noise level in the pickup area, and the possible desire to manipulate the comparative volume levels of different sound sources, as well as the overall volume.

Thus, the various considerations to be made in selecting components for a sound reenforcing system may be classified as: the type of sound and the pickup area on the stage; the seating capacity and the cubical volume of the auditorium; the seating arrangement, and the sound level controls.

In choosing the correct components for a particular job, a knowledge of the various available types of microphones, amplifiers, loudspeakers, and sound level controls is essential. The purpose of each type must likewise be known, in order that the system may perform at its fullest efficiency. A brief analysis of the popular types, showing the conditions for which each are best suited, may be of particular interest.

● Types of Microphones

There are three classifications in which microphones may be grouped: pressure, velocity, and combined pressure-velocity. Each group has a certain performance characteristic which makes its selection advisable for a particular application. After the group has been determined, a particular microphone must be chosen in that group which meets the requirements of pickup distance, angle of pickup, and mounting. The important physical property of ruggedness for outdoor use is purposely omitted, inasmuch as this discussion is being confined to indoor theatre systems.

A pressure microphone operates on the sound pressure principle, as the name implies. When a sound wave strikes the diaphragm, displacement of the diaphragm from its mid-position takes place, resulting in movement of the voltage generating medium; whether it be the compression of carbon granules, the movement of an inductor bar, the movement of a voice coil, or a change in the capacity of condenser plates, the principle is the same in all cases.

The identity of units in this pressure group are carbon, condenser, dynamic, inductor, sound power, and crystal microphones. In general, this group is best adapted to a short pickup in an area straight out from the face of the diaphragm. High-frequency attenuation is apparent with increasing angles of incidence. Where more than one voice must be picked up from a group of persons surrounding such a type microphone, best performance will result by mounting it face up, with its rear pointing straight down to the floor. However, for close talking work, the pressure type microphone is ideal.

The velocity group includes all the so-called "ribbon" microphones, in which an extremely flexible metal ribbon is suspended between two pole pieces. Both face and back of the ribbon are exposed to free air, so that air vibrations produced by sound cause corresponding vibration of the ribbon. The generated voltage is directly proportional to the sound intensity and practically independent of frequency. Its extremely wide angle of pickup, equal from its face or rear, and its zero pickup, or null points, on both sides, gives it marked advantages over the pressure type.

The combined pressure-velocity group includes all the late unidirectional microphones. Obviously, it combines the principles of both previous groups in its operation. Its response characteristic is similar to the velocity type, except that it is not susceptible to sounds striking its rear. This makes it particularly suitable for a high percentage of sound reenforcing applications where sound deflections, feedback from loudspeakers, and audience noise might become quite a problem.

From the foregoing, it is apparent that a good inductor microphone may be used for announcing and for public address duty. A velocity microphone should be used for large areas where speech, music, or both, are to be picked up. In those installations where the finest available quality is desired, or where severe difficulties are encountered with feedback, sound reflections, or high noise level, the unidirectional microphone should be used.

The most simple sound pickup requirement is that of a single announcer, lecturer, or a small group of persons,

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TELEVISION IN THE HOME

(Reprint of a letter to the editor of The New York Times.)

Your editorial "Television's Big Screen" is significant in its implications, but it misses the main issue. Screens much larger than the one you mention were in use in Europe more than a year ago.

Television's real obstacles center about the fact that the efforts of its promoters have been directed primarily at the home —"a theatre in every home" is the way it has been put.

Television, like all visual entertainment media, requires an unwavering fixity of attention on the viewer's part. But completely fixed, prolonged attention is made possible only when there also exists a sense of group identification of the kind experienced in the public theatre. For that reason the home is no place for a theatre, just as it is no place for a church —in both cases the sense of human communion established depends on the actual physical presence of one's fellow-men.

Consequently, while television offers almost unlimited possibilities for further expansion to the motion pictures and the theatre, it satisfies no deeply rooted human need in the home. This is the stone wall against which television's promoters have unwittingly been battering themselves.—Irving Fiske.

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More than 600 Mid-West circuit theatres—including Balaban & Katz and Minnesota Amusement Co.—have been using Droll Patented Process carbons for 2 years—with complete satisfaction.

THE Droll Carbon Process is the first such to win complete acceptance by both projectionist and exhibitor—the former because it is the only such process to render absolute safety and satisfaction without requiring any extra work; the latter because it positively saves a minimum of 20% of his carbon bill.

Droll Patented Process carbons are now available to users of the following carbon trims:

SUPREX CARBON TRIMS

Negatives	*Positives*
6 mm. x 9	6 mm. x 12
6.5 mm. x 9	7 mm. x 12
7 mm. x 9	8 mm. x 12

AND the 13.6 mm. x 22 High-Intensity

By the Droll Process, a carbon is so drilled on one end as to make a female opening; the other end is drilled for a male opening. The projectionist need only join the carbons together and clip them with a metal sleeve of pure copper —the same as the outside jacket of the carbon.

ALL DROLL PROCESS CARBONS REACH THE PROJECTION ROOM FULLY PREPARED AND READY FOR USE.

†U. S. Patent 2,120,243.

When the positive carbon is about 3 or 4 inches long, you simply insert the next carbon in the milled-out part, slipping the copper sleeve over the stub. This copper sleeve matches exactly the copper coating on the carbon. That's all there is to it—simplicity itself.

Although burning the carbon to about ½ or ¾ inch from the connection is recommended, it is possible to effect continuous burning with slight extra care.

So pronounced has been the success enjoyed by this sensational new process that we invite all projectionists to

Send for Free Samples

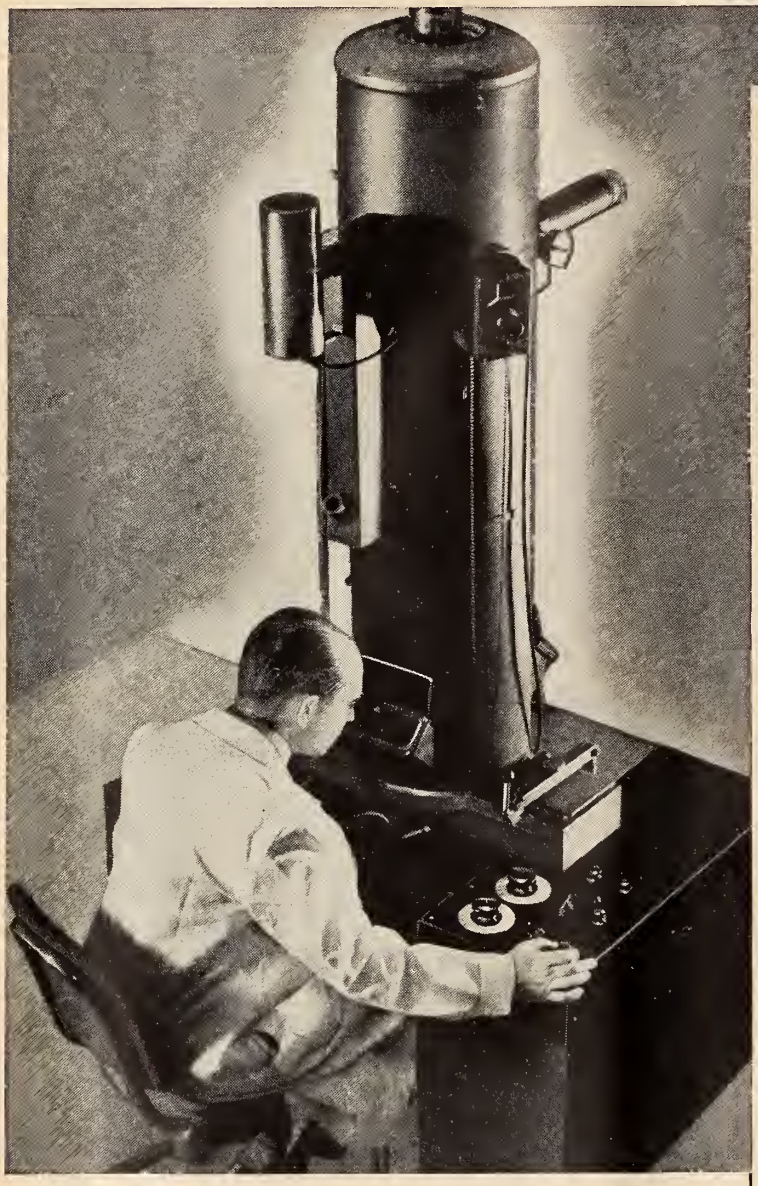
Just one trial of this type carbon will convince you of its absolute efficiency, ease of handling—plus at least a 20% saving. Write us today.

DROLL THEATRE SUPPLY CO.

GUS ANDERS, MGR.

351 East Ohio St. Chicago, Ill.

Looking at the sound picture  ***from the projectionist's port-hole***



Research

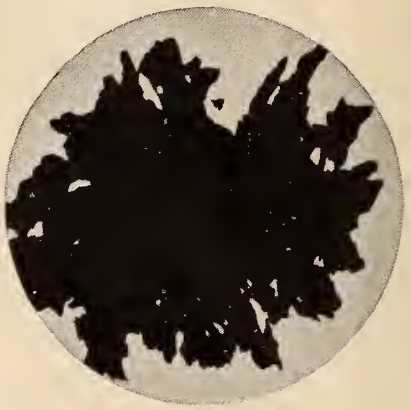
Helps RCA Help You!

From the RCA Laboratories have come many contributions to the great art of electronics. Among these are the RCA Photophone Magic Voice of the Screen ...RCA Victor Radios and RCA Victrolas ...RCA Victor Television ... and now the RCA Electron Microscope, illustrated.

Developed by Dr. V. K. Zworykin—whose contributions to television are monumental—and his associates, this microscope is a striking example of the way RCA research plays an important part in little known fields. It electronically magnifies objects 20 to 50 times the size possible with the finest optical microscope available. Bacteria or other minute particles are magnified to 25,000 times by the RCA Electron Microscope.

What does this mean to you?

Just this: By constantly delving into the mysteries of electronics, RCA engineers solve problems which in the theatre field make possible better sound reproducing equipment. As a result, *your* work is made easier, better and more pleasant—when you provide quality presentations to movie-goers with the RCA Photophone Magic Voice of the Screen!



Commercial iron oxide as used for finest polishing operations, magnified 15,000 times by RCA Electron Microscope

AT YOUR SERVICE

RCA Photophone field engineers are always ready and eager to serve you. Backed by RCA research and experience in sound recording and reproduction, the engineer near you will be happy to help you with any problems you may have—and in addition, solicits your suggestions and criticisms for the further improvement of RCA Photophone Equipment—the best in the business!

RCA **PHOTOPHONE**

MAGIC VOICE OF THE SCREEN

RCA Manufacturing Company, Inc., Camden, N. J. • A Service of the Radio Corporation of America

remaining always within a fixed small area on the stage. A single microphone will do this job well, mounted on a floor stand, or a banquet stand, as the occasion may warrant. Where one announcer or lecturer may be moving about within an area too great for one fixed microphone, a lapel-type microphone, fastened to the lapel of the speaker's coat and connected with a suitable loose and flexible cable, will prove very convenient and satisfactory.

For the reenforcing of an orchestra, either on the stage or in the orchestra pit, at least two microphones on program stands should be used. For large orchestras, where soloists have to be accentuated, it is obvious that more than two pickup units will be needed. The exact location of each, to obtain the most natural overall balance of all instruments, must be determined by experiment.

Where the pickup area is great, such as the entire stage area for vaudeville and stage productions, at least four microphones should be used. One should be mounted on a floor stand for possible solo and announcement work, and the remaining three units should be mounted in the footlight trough, as shown in Fig. 1. One unit is usually placed on the stage center line and the remaining units on each side. The distance between microphones in the footlight trough should not be less than 8 feet, and not more than 10 feet. Where no footlight trough is available, Fig. 2 illustrates a method which may be used.

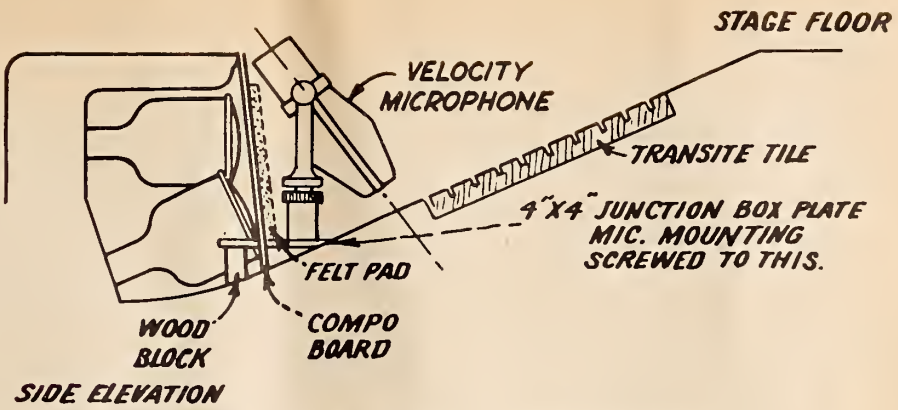


FIGURE 1. *Detail of footlight microphone mountings.*

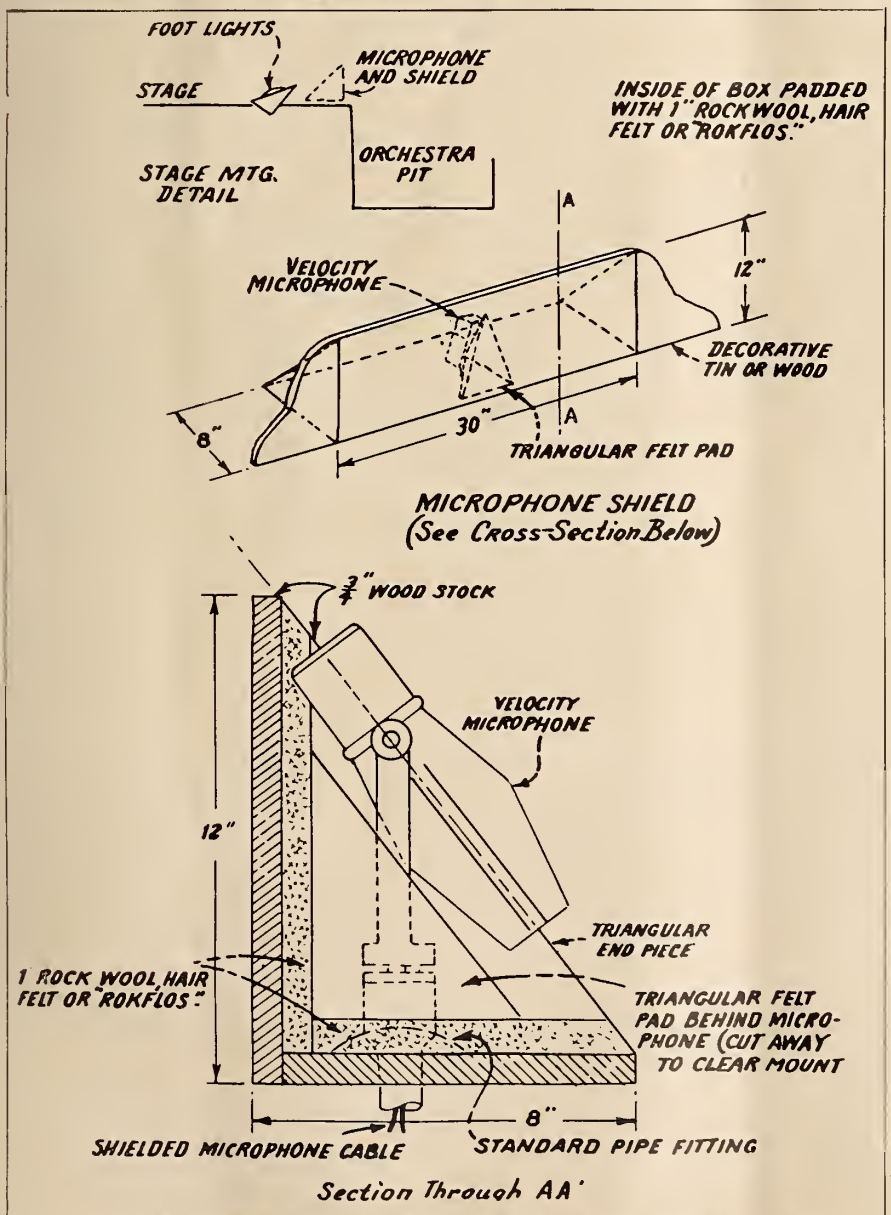


FIGURE 2. *Suggested mounting on stage having no footlight trough.*

● Amplifier Data

In discussing amplifiers, only the important general features and characteristics will be covered. There are so many interesting details that volumes might be written in a comprehensive analysis; however, space limitation permits only a very general summation pertinent to the selecting of a proper unit for reenforcement.

As was stated previously, power output and overall system gain must receive first consideration. The efficiency of various types of loudspeakers has been sufficiently established so as to permit power output determination directly from the cubical volume of the auditorium. A suitable margin, as protection against overloading, should be allowed to permit faithful peak volume performance. The necessary gain of the system is easily determined from the sensitivity of the selected microphone, the average sound pressure to be exerted on the microphone, the attenuation of any mixers if used, and the established power output.

Consideration should also be given to percentage of total harmonic distortion, frequency response, hum level, and accessible controls for compensation. Modern design practice includes inverse feedback circuits which reduce distortion, eliminate undesirable peaks in the frequency response, and provide excellent output voltage regulation when various loudspeakers are thrown on or off the line. The frequency response should be uniform for the faithful reproduction of tones from all musical instruments. Compensation controls are advantageous.

especially to obtain an attenuation of low frequencies for clear and crisp reproduction of speech.

The physical properties and installation location of amplifiers for reenforcing systems in theatres depends somewhat on the manufacturer's design, and whether the system is styled for portable or permanently installed use. In the latter case, the larger power output channels consist of separate voltage and power amplifier units, completely a.c. operated. Where a number of microphones are necessary, each microphone should have a preamplifier feeding the mixer control, which combines all the sound sources and feeds the voltage amplifier.

The rack or cabinet for housing all amplifier units is usually mounted in a wing of the stage or the projection room, the former being the more common practice. If the sound volume is controlled only at the amplifier, then it should be so located that the volume operator has an unobstructed view of the stage.

● Anent Loudspeakers

Loudspeakers play a very important part in reenforcement systems, as they are the medium through which sound is projected and distributed to the listeners. Speaker units have become well established in regard to a cone or a diaphragm type moving element, and a permanent magnet or a separately excited field. The important consideration in loudspeakers is in the type baffle or horn selection. Flat baffles, folded baffles, large throat directional baffles, and small throat multi-cellular horns are among the various types in common use, each having different characteristics relative to efficiency, frequency response, and projection ability.

Flat baffles will give satisfactory results for small or medium sized audiences confined in an area not too distant from the loudspeaker. It has a good response in which the amount of low frequency is governed by the area of the baffle.

Where sound must be projected an appreciable distance, and its distribution restricted so as not to directly strike side walls or other reflective surfaces, directional baffles or horns should be used. The large throat baffle has been commonly selected for reenforcement systems because of its directional characteristc, higher efficiency and its good response over the speech and music range. In deluxe installations, where the best available is desired, the multi-cellular horn and the low-frequency folded baffle combined in a two-way speaker system will give the very finest performance.

Although the focussing of a directional speaker depends on the relative location of the area to be covered, its placement with respect to the sound source directly affects illusion. Sound presence should attract listeners to the sound source; *i. e.*, the loudspeakers should be located as closely as possible to the microphones. In striving for this, caution should be used to see that acoustic feed-back between loudspeakers and microphones does not take place and thus affect the maximum usable over-all gain of the system.

Loudspeakers should be so mounted that the projected sound beam does not pass through the microphone pick-up area. For these reasons, reenforcement speakers should be mounted above or on both sides of the stage proscenium arch. Fig. 3 illustrates a suggested method for such mounting.

● Mixers, Volume Controls

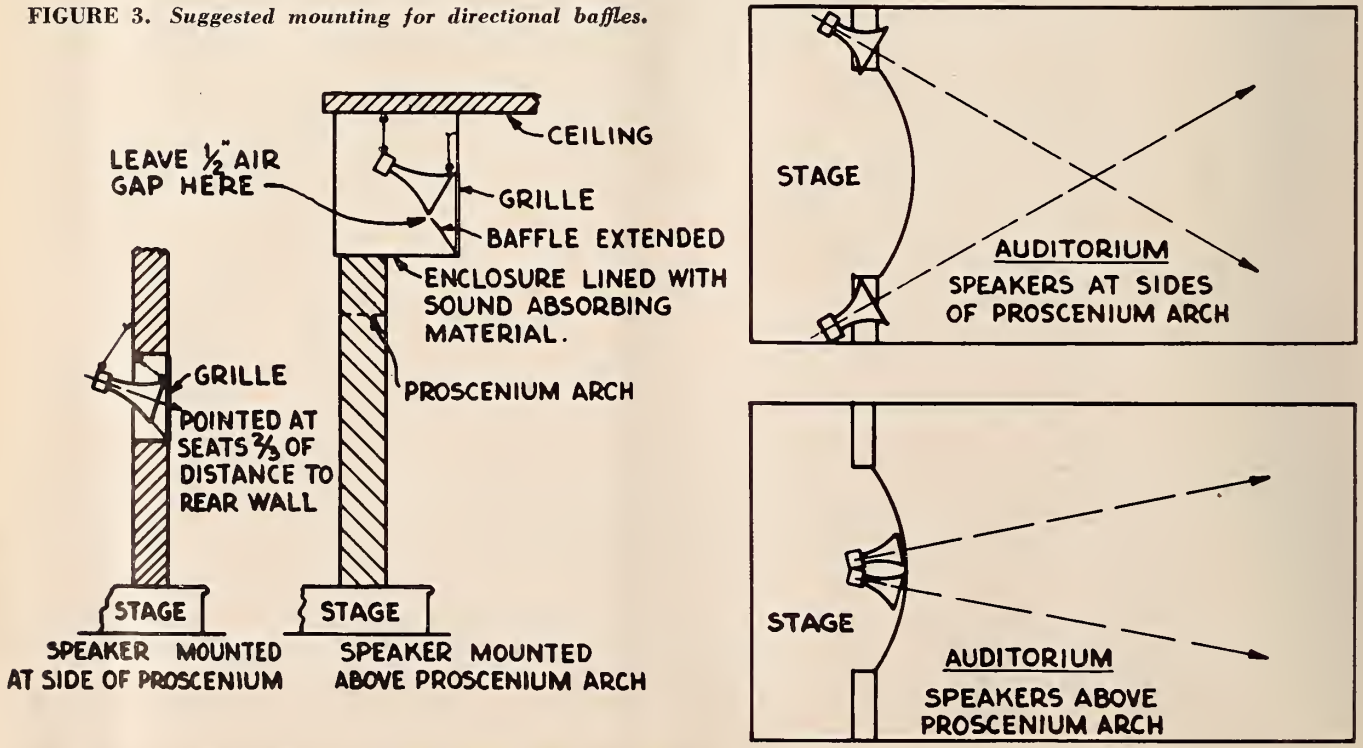
A mixer may be described as a device for combining the sounds picked up by a group of microphones into a single circuit which feeds the amplifier input. It usually includes a variable attenuator for each microphone as well as a master attenuator for adjusting the overall sound level. Thus, the level of each microphone may be individually changed to produce any desired effect.

Mixers are usually located in a high level portion of the circuit, so that possible noise from shifting contacts in the attenuator pads, as well as stray field interference, might be kept at a minimum. Inasmuch as mixers should be so located that the mixer operator has an unobstructed view of the stage, as well as a first-hand knowledge of the sound volume in the auditorium, long lines of shielded lead cables to a suitable mixer location greatly increases the installation cost.

To overcome these objections of noisy controls, mixer insertion loss,

(*Continued on page* 29)

FIGURE 3. ***Suggested mounting for directional baffles.***



PACEMAKERS

ENDOWED with special abilities in their special fields, and governed by supercritical manufacturing controls, Eastman negative films set the pace for raw-film quality. They share with cameraman and processing laboratory the credit for the unprecedented photographic excellence of today's motion pictures. Eastman Kodak Company, Rochester, N. Y.

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PLUS-X
for general studio use

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for all difficult shots

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for backgrounds and general exterior work

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Now After Exhaustive Comparative Tests

FILM-WELD

Successor to Film Cement

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WARNER BROTHERS EXCHANGES

Exchange work makes exacting demands upon a film binding agent. The splice must be made secure—and quickly. Now, in Warner exchanges splices are made the modern way—with FILM-WELD, the successor to film cement. Now, America's theatres receive Warner reels with thinner yet more rugged splices.

This progressive move by Warner exchanges was the inevitable result of a series of exacting and exhaustive tests during which all makes of film cement and FILM-WELD were put to the acid test. FILM-WELD's superiority on all counts was overwhelmingly established.

And why not? Warner exchanges now need not empty their cement bottles twice daily, nor be careful not to expose too much cement at one time. Because FILM-WELD does not thicken, spoil or discolor—even when exposed to the air. It retains its full strength down to the last drop, requiring no thinning agent. It firmly binds all film—nitrate, acetate, black-and-white and color. It goes twice as far as ordinary film cement—naturally.

First proven best on the projection firing line in thousands of theatres, FILM-WELD now delivers perfect results in major exchanges. And Warner is but the first such group to adopt FILM-WELD—more are on the way. Get your FILM-WELD from any one of the 108 dealers throughout America who now stock this modern splicing agent.

———*Instructions for use*———

FILM-WELD should never be put into a container that has been used for film cement, or a brush used that has been used with film cement. Use FILM-WELD sparingly; just enough to moisten the film is sufficient, as any excess slows up the drying process.

On prints that have been treated with emulsion hardener, it is necessary not only to remove the emulsion, but the film itself must be scraped, so as to remove the hardener. The non-emulsion side should also be scraped.

Color film should be scraped on both sides.

FILM-WELD not being a cement but a bonding agent, it is absolutely necessary to remove any foreign matter so that the two films themselves are brought into contact.

If these directions are followed, a permanent bond will result.

LARRY STRONG, INC.

1241 So. Wabash Ave., Chicago, Ill.

I. A. 35th Bi-Ennial Convention Report

REAFFIRMATION of the confidence of the general membership in the ability and integrity of its officers by means of blanket resolutions of endorsement which met with unanimous approval was the highlight of the Thirty-Fifth Biennial Convention of the International Alliance recently concluded in Louisville, Kentucky. Although such action was forecast before the delegates assembled, the unanimity of the move was considered highly significant in view of the fury of the pre-convention press attacks upon Alliance officers.

These resolutions of confidence blazed the way to the anticipated action of the convention in re-electing all International officers, with the exception of the naming of Felix Snow, of Kansas City, as seventh vice-president in place of John P. Nick, resigned. In addition to Snow, the official slate is now comprised of George E. Browne, International President; Harland Holmden, 1st v-p.; W. P. Covert, 2nd v-p.; Richard F. Walsh, 3rd v-p.; Floyd M. Billingsley, 4th v-p.; James J. Brennan, 5th v-p.; Roger M. Kennedy, 6th v-p.; and Louis Krouse, Gen. Sec.-Treas.

The Louisville local unions, Nos. 17 and 163, did themselves proud on the arrangements, with everything moving smoothly throughout the four-day meeting. In fact, this was one of the smoothest-running I. A. conventions on record, there being no electioneering, no extended floor squabbles, and the conduct of the delegates being exemplary. So pronounced was the decorum of the delegates that it induced comment from the convention chairman.

Alliance Much Stronger

Impressive evidence of the growth of the Alliance in financial and numerical strength was given by the report of Gen. Sec.-Treas. Louis Krouse, who revealed that in the past two years. I. A. finances had increased by $116,226.76 to a new high of $344,795.41. Buttressing this assertion was the report of the Credentials Committee as accepted by the convention: 872 delegates as compared with the 600 who registered at the 1934 I. A. meeting.

It is no exaggeration to state that more than 60% of the effort and time of this Convention—from the President's report right down to the closing moments—was devoted to the West Coast studio situation. This has been the case for the past three I. A. conventions, at least. In casting about for reasons why this should be so one would have to conclude from the evidence at hand that three factors are primarily responsible: first, the notorious anti-labor feeling in California; second, the efforts of the C. I. O. groups on the Coast to "muscle in" on A. F. of L. domain, particularly that of the I. A., and finally, the widespread infiltration of Communists into A. F. of L. ranks.

President Browne's report stated unequivocally that 90% of I. A. troubles with its studio units were due to joint Communist-C. I. O. pressure. The report, incidentally, made no differentiation between these two organizations. In fact, photostatic documents attached to the President's report purported to show that the Communist program matched in all particulars that of the C. I. O., and particularly so anent the almost fanatical desire to smash the I. A. that is evidenced therein. Moreover, President Browne stated flatly that he is aware of Communist incursions into I. A. ranks—a situation which, he said, will be dealt with "appropriately" in the near future.

Overall, the bulk of I. A. Convention delegates must be getting extremely tired of and bored with these ever-present West Coast studio unit squabbles; although it is recognized by all concerned that the studio units constitute an indispensable I. A. asset.



GEORGE E. BROWNE
Re-elected I. A. prexy for 4 years

Many Guest Speakers

Among the more important speakers were President William Green of the A. F. of L.; George M. Breslin, attorney for the I. A. on the West Coast; Matthew Levy, attorney for Local 306 of N. Y. City; Congressman William T. Schulte, an I. A. man; Matthew Woll, a v-p. of the A. F. of L., and Joseph Padway, general counsel for the I. A. In fact, there were so many speakers expounding their pet theories or repetitiously covering the same ground as their predecessors that the scene was reminiscent of a convention of one of the major political parties. A deluge of words, verily.

President Green made four noteworthy points: that the I. A. is "the greatest union in the constellation of 106 under the A. F. of L. banner"; that every effort had been made to placate the C. I. O. dissidents from A. F. of L. ranks, all to no avail because the C. I. O. constantly ducked the issues involved; that U. S. Labor would enthusiastically support the defense of Canada by the U. S. in the event of invasion by a foreign power, and finally, but by no means least, that all Internationals under the A. F. of L. banner have "autonomy" and thus are not subject to "orders" from the A. F. of L.—this last a pointed reference to those newspapers which have been calling upon Green to intercede in I. A. affairs.

Mr. Breslin explained the various legal steps taken to combat the Communist-C. I. O. "menace" on the West Coast. He also gave President Browne and his representative, William Bioff, a fine send-off, lauding their ability and integrity. General Counsel Padway discussed the implications of various anti-labor laws now being passed in several states, in addition to castigating the efforts of Thurman Arnold, asst. U. S. Attorney General, to restrict picketing activities in jurisdictional disputes through invocation of the anti-trust laws. Matthew Levy excoriated Communists and advocated their ex-

pulsion from labor organizations. The Communists were accorded top wordage in the Convention proceedings.

● Social Security Bids

Two resolutions, of the fifty offered, were of extreme social significance to the general membership. One of these, a group insurance plan advocated by Matthew Woll as president of the Union Labor Life Insurance Co., was decisively beaten in the final reckoning. This resolution, which had the almost solid support of the older stagehand members, was finally beaten by a coalition group which, strangely enough, included some stagehands, the fundamental objection of the opposition group being that the proposed rate was too high.

Another resolution provided for the imposition by the I. A. of a special assessment which would go into a fund to provide some manner of retirement pension for aged and incapacitated members no longer able to work. This resolution, which had strong combined support of all crafts within the I. A., was finally referred to the Executive Board after spirited discussion on the convention floor.

A flock of resolutions sponsored by District No. 2 (West Coast), and seeking changes in the I. A. Constitution to the end that certain forms of studio work should be more clearly defined, were referred to the Executive Board. Canadian locals, citing the rapid spread of dual unionism in their territory as a result, they charged, of collusion with exhibition interests, asked for the full support of the Alliance in fighting this menace. This was passed.

● Beat Procedure Changes

Delegates from the Laboratory Technicians Local 683 (Hollywood) in a resolution covering four pages, requested two important changes in current I. A. procedure: first, that the present emergency power vested in the Executive Board be modified to insure some degree of authority in such proceedings by the Local Union affected, and second, that no assessment of whatever character be levied upon the Alliance without a referendum vote by the general membership. Both these resolutions were lost, following recommendations by the Resolutions Committee for nonconcurrence.

One resolution dealing with "subversive" propaganda or conduct, passed by the Convention, would seem to invite not a little trouble in the future, including some extensive workouts in various courts. After citing extensive current Communist-Fascist-Nazi propaganda efforts within local unions the resolution continues:

> ". . . that the General Executive Board be and is hereby authorized and empowered to promulgate such by-laws, rules and regulations as in its judgment may be deemed proper and expedient to fine, suspend and expel from this International Alliance, or to otherwise discipline, such members thereof as engage in subversive propaganda or conduct, to the detriment of this International Alliance or of its affiliated organizations."

This resolution is noteworthy by the absence therein of any definition of "subversive propaganda or conduct," or any means for enabling a member so accused to have a fair trial before an impartial group. Under this resolution it appears that a confirmed pacifist who opposed a declaration of war could be summarily expelled from the Alliance, even though he loathed the very mention of totalitarian government.

The request of delegates from B locals for advancement to full A-local status was referred to the General Office. Ditto for a request that the Alliance exert every effort to institute a 30-hour week for I. A. men generally. To the Executive Board was left the decision on a request for a "clear and definite" interpretation of jurisdictional rights over special equipment, including dummy sound heads and auditorium volume control units, which, stated Resolution No. 11, becomes an "integral part of the projection and sound equipment."

● 'Inclusive' Service Contract

A question of extreme interest to the general Alliance membership, and particularly projectionists, was that of the new inclusive service contract recently introduced by sound equipment service organizations. Discussing this new contract in his report to the Convention, President Browne stated:

> ". . . I realize the possibilities of some undesirable provisions creeping in . . . I would suggest the appointment of a committee, who could be selected along geographical lines, which would reflect a diversity of opinion. This committee could study the provisions of such agreement, and since they have already had an opportunity during the course of the past two years to become cognizant of any derogatory clauses or commitments, proper recommendations could be made for their deletion, or on the other hand, the inclusion of beneficial features, in the new agreement."

This recommendation of President Browne was adopted by the Convention, and a special committee was formed to consider all angles of sound picture equipment servicing, with special emphasis on the "inclusive" angle of parts supply. A definite statement of policy on this question is expected to be forthcoming from the General Office shortly.

Locals 17 and 163, of Louisville, did not neglect the social aspects of the Convention. A total of 1,500 delegates and guests were in attendance, with the number of ladies being the largest of any I. A. gathering to date. In behalf of the latter there toiled unceasingly a Ladies Committee which staged many get-togethers, including a standout fish-fry party just out of town.

The *piece de resistance*, of course, was the I. A. Ball held on the evening of the third day of the Convention. The thermometer was up in the 80's, but this did not deter the Convention from putting on a rousing celebration.

A cause for keen regret among many delegates was the absence of any organized display of equipment by manufacturers of projection and stage units. These exhibits, when staged in the past, have been of inestimable value to both the delegates and the manufacturers, and the hope was expressed on all sides that future I. A. gatherings will not overlook such a splendid opportunity for the exchange of mutually profitable news and views.

COLOR PROJECTION PROCESS

History repeating itself: the current announcement that the problem of projecting color films from black-and-white films has been solved to the "complete satisfaction" of Prismicolor Co., of Chicago. This harks back to twenty years ago and more when Kinemacolor and other companies were "on the verge" of licking color projection.

This latest foray on the color projection front utilizes, as did all of its predecessors, projector attachments. These color film sponsors, and those playing with stereoscopic motion pictures, invariably rely upon projector attachments, our opinion of which is too well known to need recounting here. Right now there are more attachments on a projector than is decent or necessary. Pedestal makers please take note.—J. J. F.

M. D. Faige, RCA Photophone Field Engineer in New England, recently completed a two weeks stay in Camden in preparation for new duties as Service Manager of the Atlanta District, replacing G. P. Knapp, assigned to other duties. Mr. Faige is being succeeded by H. I. Hultgren, long associated with theatre sound service and well known to New England exhibitors.

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Rely on the manufacturer that year after year builds the finest projection arc lamps. Get the facts on the latest Strong development.

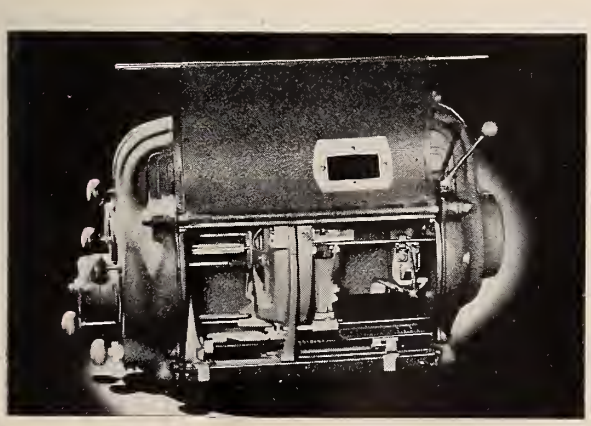
THE UTILITY INTERMEDIATE CAPACITY HIGH INTENSITY LAMP

for the moderate sized theatre using a screen up to 18 feet in width, where high intensity projection has been heretofore denied by prohibitive operating cost.

To secure the desired screen brilliancy with the present dense black-and-white and the colored films, twice as much light is required as is possible to project by any low-intensity lamp.

This necessary doubling in light over the low intensity has been made possible at an increased combined current and carbon cost of less than 2c per hour.

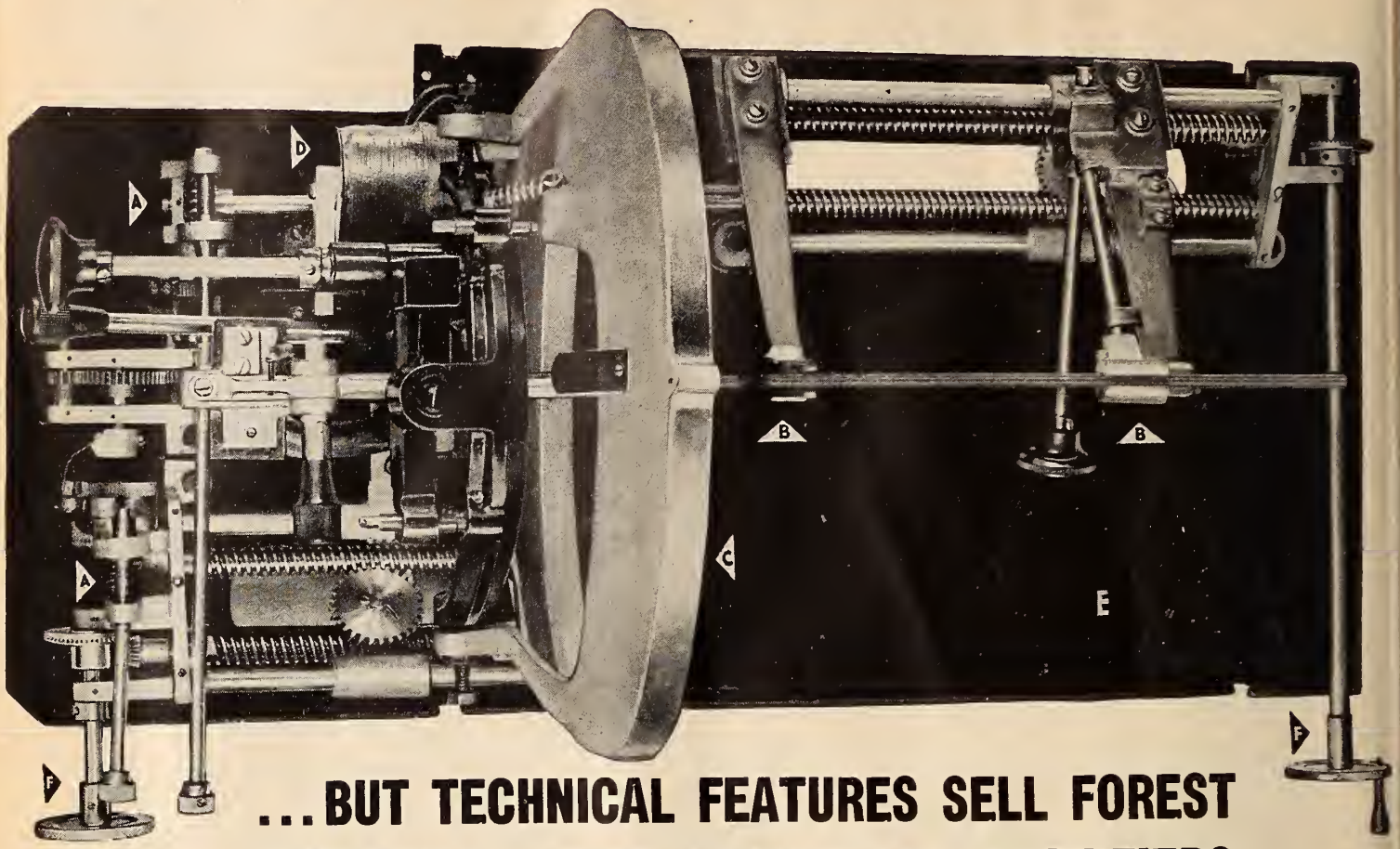
The snow-white light secured by the Utility makes the low-intensity appear a muddy yellow by comparison.



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...BUT TECHNICAL FEATURES SELL FOREST 'UNIVERSAL TRIM' LAMPS AND RECTIFIERS —THE BALANCED 'ARC-LIGHT' COMBINATION

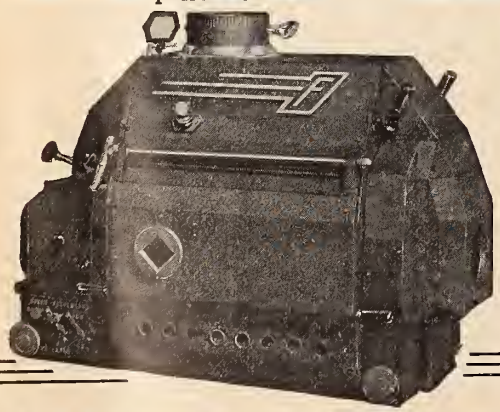
A New patented arc feed . . . separate positive and separate negative feed mechanisms.

B 'Universal Trim' . . . from Low Intensity to Suprex-Simplified High Intensity projection.

C Bausch & Lomb Reflector Mirror . . . can be adjusted laterally and vertically—forward or backward . . . insures maximum illumination.

D Electro-magnet with adjustable arm . . . magnetic influence can be adjusted to suit draft and other operating conditions.

E Floor of lamp house clear of all mechanisms . . . eases cleaning.



F Manual feed handles . . . do not interfere with electrical controls.

Forest Sound Screens round out the Forest Balanced 'arc-light' Combination. The special Forest surface-processing method eliminates the necessity of increasing amperage at the arc to obtain more light because Forest Screens retain their original white surface . . . longer. There is a complete Forest Screen line . . . all flame-proofed.

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SUPER MCS RECTIFIERS
LD-60 BULB TYPE RECTIFIERS

● Super MCS Rectifiers —improved equipment for Suprex-Simplified High Intensity projection. Three-phase fan, magnetic switches, automatic voltage regulator, visual three phase line indicator.

● LD-60 Bulb Type Rectifiers—important new circuits conform with every requirement of modern projection—output from 30 to 65 amperes. All Forest Rectifiers are sturdily built and approved by Underwriters Laboratories.

Theatre Sound System Standardization

By *JOHN K. HILLIARD*

RESEARCH COUNCIL, ACADEMY OF MOTION PICTURE ARTS & SCIENCES

THE Theatre Standardization Committee of the Research Council of the Academy of M. P. Arts & Sciences was formed in 1936 as a result of an exhaustive investigation covering hundreds of theatres which showed that sound reproduction varied to such an extent that it was impossible to obtain uniform quality. Each member of the Committee is a technical expert in the field of sound.

Early in this program we assembled a test reel containing a short length of a regular release print from each of the studios. This assembled reel, with both picture and sound, was used as a means of coordinating listening tests held in the theatres. This particular test reel proved to be so valuable that prints were made available at cost, upon request, to service companies, equipment manufacturers, and theatres. Since its original release we have revised and shortened the reel, and several hundred prints, are now in use throughout the world.

Our ultimate aim is to make sound from all studios reproduce equally well in each theatre—at least to bring all theatres up to a commercially acceptable quality-level.

The Council naturally recognizes the value of engineering, testing and checking of theatre equipment, but we have based our entire theatre standardization program upon the fundamental fact that the *final* determination should be a *listening* test. And I mean a listening test of the *equipment* as *installed* and *adjusted* in the theatre. For this reason all our standards have been based so far upon listening tests correlated with engineering data.

● Standard Adjustment

From an engineering standpoint, the ultimate aim in this work is the specification of acoustical standards which will place these listening tests upon a scientific basis. At the present time there is not sufficient acoustical information available upon which to base any standard acoustical specifications. The Council is working on this problem, which we hope will eventually assemble enough data to permit setting up standard methods of acoustical measurements that will be of use in adjusting theatre equipment.

As a result of the Committee's experience and listening tests with our theatre reel, a standard method of theatre adjustment for all of the better known sound systems has been set up and, wherever possible, manufacturers and service organizations are following these specifications when installing and maintaining equipment.

Experience has shown that the use of these standard adjustments lead to the best overall quality obtainable with current sound recordings as reproduced on theatre equipment with two-way horn systems. In most cases a slightly different adjustment is necessary for each make and type of loudspeaker system. However, hundreds of recent installations have borne out the fact that if theatres are so adjusted, the product of any one producer is not penalized, and the overall quality of all product is more uniform.

The quality obtained is modified, of course, by acoustical conditions in the theatre itself, but it has also been found that even where bad acoustical conditions exist the effect of these conditions on the product is minimized if these standard adjustments are used.

● Performance Standards

The usual manner in which this type of standardization takes place is through the manufacturing and service organizations, as they are in closer touch with the studios and with technical advancements which may take place at the source of the product. Accordingly, the exhibitor is not always conscious of the fact that this sort of progress is taking place. Consequently we are striving to make our activities of actual, tangible benefit to the exhibitor.

One thing which we have done along this line is to prepare recommendations on performance standards for theatre sound reproducing equipment. Previous to the issuance of these recommendations, exhibitors were forced to rely primarily upon statements of salesmen for information as to equipment.

After conferences extending over a year's time, participated in by representatives of the studio sound departments, equipment manufacturers, and the theatre service groups, the Research Council published these recommendations, which constitute an unbiased, impartial source of information on the standards to which any sound equipment should measure up to.

While we of course do not advise on specific equipments by name, we have set up minimum requirements for equipment performance which are sufficient to guide one in these matters. One thing you may be sure of—if you follow our recommendations, you will avoid buying equipment which is not representative of the best available. On the other hand, such equipment will have no unnecessary features which would add to the cost of installation and maintenance.

Our standardization activities have been considered so important by the sound equipment manufacturers that during the past few years all of the major equipment manufacturers have sent representatives to Hollywood to consult with us every few months. In addition, permanent Hollywood representatives are maintained here by a number of companies who cooperate with the Committee and with whom we are in constant consultation.

As a result of this phase of our program it is now possible for the exhibitor to purchase better sound equipment at a lower price than would have been possible without the Committee's coordinating efforts. While the Committee cannot of course claim credit entirely, we believe, for example, that we have contributed to making it possible for you to now purchase 50 watts of power in your equipment for the approximate price of 2½ watts ten years ago.

● Power Requirements

Let me briefly discuss the matter of power. Many people believe that the volume of sound—that is, the loudness—that can be obtained in a theatre, depends entirely upon the amount of power installed. This is only partially true. Power is required for increased loudness for the proper presentation of special effects such as the earthquake in "San Francisco," the breaking up of the icebergs in "Spawn of the North" or the breaking of the dam and the resulting flood in "The

Rains Came." But, also, from a quality standpoint adequate power is necessary to reproduce dialogue and music at normal levels without harshness and unnaturalness.

As a result of a great deal of study of amplifier power requirements, the Council is issuing recommendations on the minimum power requirements for theatre sound systems. These recommendations indicate the minimum power which should be installed in any theatre in order to give proper reproduction of current sound recording.

We have prepared the chart in Table A which indicates these minimum power requirements. You will note therein the various power requirements for specific seating capacities.

It can be easily recognized that the minimum power of 10 watts is entirely within reason. The average modern radio in your home has 5 watts, and the better sets have 10 to 15 watts of power. You may rest assured that this amount of power would not be available unless it was necessary from a quality standpoint—especially in this day of inexpensive radios where price competition is so important.

All of Hollywood's sound is being recorded with these power requirements as a basis, and if these recommendations are followed, you will be assured of obtaining the best possible quality from all types of recording.

TABLE A

Number of Seats	Minimum Power Requirements, Watts
400	10
400— 600	13
601— 750	15
751—1000	20
1001—1250	26
1251—1500	32
1501—1750	37
1751—2000	43
2001—2250	48
2251—2500	53
2501—2750	59
2751—3000	65
3001—3250	70
3251—3500	76
3501—3750	82
3751—4000	88
4001—4250	93
4251—4500	98
4501—4750	104
4751—5000	110
5001—5250	115
5251—5500	121
5501—5750	126
5751—6000	132

● Theatre Acoustics Data

I might point out one fact which has become very apparent to us since the start of our work—that many theatres encounter difficulties with their sound because of acoustic deficiencies. Our experience indicates that many exhibitors do not realize the necessity of attempting to remedy these acoustic deficiencies rather than to try to get around them by means of electrical adjustment of the sound equipment.

Oftentimes, only a few dollars worth of material properly placed in the auditorium or backstage will improve results tremendously—by giving greater sound uniformity throughout the theatre so that the maximum number of seats, regardless of their position in the auditorium, can be utilized with no discomfort to the audience.

Theatre owners often spend considerable money and give lots of thought to the subject of comfort. You work diligently to achieve eye comfort by putting a good picture on the screen. You spend money for good seats and carpets. You maintain clean and well equipped rest rooms, and attractive lobbies. But one type of comfort which in our experience we have found to be neglected is ear comfort. If your patrons must strain to hear the sound, or if they are subject to raucous and overloud sound, they will become tired just as rapidly from ear fatigue as from eye fatigue or bodily discomfort.

To achieve ear comfort, it may not be necessary to spend lots of money. Poor sound conditions can be corrected very often at small cost, the main effort being proper technical information and the manner of applying it.

Difficulty encountered in setting volume level in many theatres also results from acoustic deficiencies, in particular because of non-uniform distribution of sound throughout the house. This problem is decreased or entirely eliminated with proper distribution throughout the auditorium as given by recommended two-way speaker systems, which are universally considered to give the best results of any speakers now available.

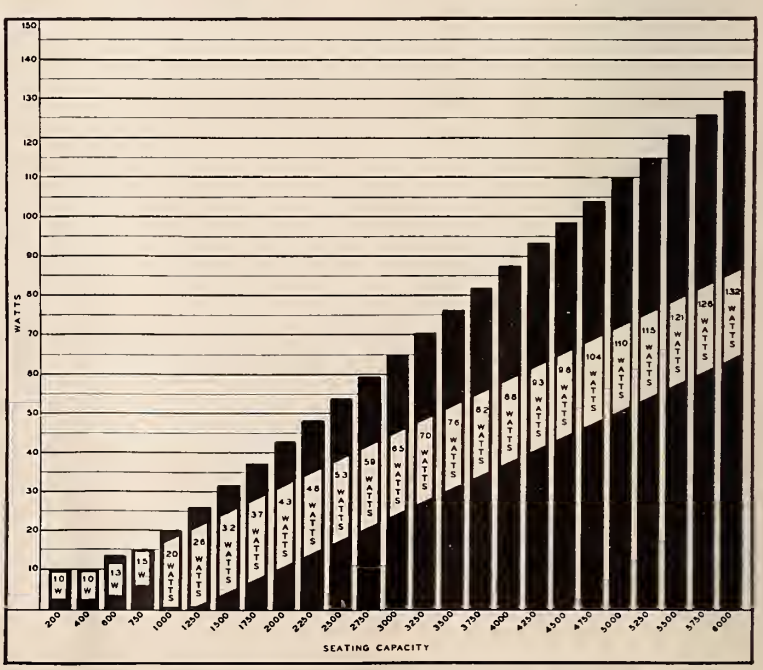
● R. P. Sound Level

We have received complaints from time to time from the field stating that some release prints will not run throughout the show on one fader setting. We realize that all of you are concerned with this problem. In the majority of cases this trouble can be traced either to poor acoustical conditions or to improper sound equipment adjustments. Where an auditorium is highly reverberant in particular frequency bands—for instance where deep male voices are accentuated, the sound level in such sequences in the reel will appear too loud for other portions of the picture. This will necessitate a fader change in such a house; while in a theatre with proper acoustics the same feature will play throughout on one fader step.

Thus it may be seen that proper acoustics contribute tremendously to the ease and time, such as projectionist and service men's time, required to obtain the best sound quality and the proper volume, and tend to maintain the proper sound level at a single fader setting throughout the feature.

Here again the commercial aspect should be given consideration as poor acoustics lead to complaints at the box

(*Continued on page* 27)



Academy Research Council minimum power requirements for theatres, based upon seating capacity

Efficient Projection Supervision†

By *HARRY RUBIN*

PARAMOUNT THEATRES SERVICE CORP.

The importance of thorough and continuous supervision of projection and sound equipments in the theatres, some of the problems connected therewith in the construction and the maintenance of the theatres; a brief outline of a few of the many details that must be examined and precautions that must be observed in order that the motion picture entertainment may be presented under the most nearly perfect conditions, are described herein by a projection supervisor for a theatre chain. Emphasis is placed upon the benefits to be derived through the close cooperation between the supervisor and the projection personnel of the individual theatres and several measures for accomplishing this result are cited.

AS IS generally well known, supervision of projection and sound equipment is intended to effect the following results: (1) To institute and to maintain conditions under which theatre patrons may see and hear film plays with a maximum degree of comfort, safety, and satisfaction during the entire performance.

(2) To promote the most efficient methods of operation through the elimination of waste; by discovering incipient troubles and correcting these conditions before breakdown or other serious difficulties actually occur; by furnishing instructions and information regarding the routine work and duties of the projection personnel; by installing systems and schedules covering checking, lubrication, and cleaning of all items of equipment; and by investigating new devices offered to the trade, testing such devices and, after making a thorough study of all factors involved in connection with each particular theatre, advising these theatres whether or not the substitution of the new devices for their present equipment would improve their screen or sound results or would effect reductions in operating costs.

In a paper such as this would seem logical to begin at the point where thorough supervision should begin, *i. e.*, while the theatre is still in the blueprint stage. The supervisor should study each proposed theatre layout and advise the incorporation therein of every detail and item of equipment that will best achieve the objectives set forth above. He should check all wiring and conduit sizes, the capacities of switches and fuses, the estimated load of each circuit, and see that all sound and projection circuits, and also the emergency house-lighting circuits, are so installed and independently protected that trouble originating in any other circuits will not affect their proper operation.

● Basic Room Requisites

He should make certain that the projection room is provided with facilities that will make it healthful, comfortable, and safe for the occupants. This means that adequate ventilation for disposal of gases generated by the arc, heating and cooling of the projection room, and running water and toilet facilities should be included. Proper approaches and entrances to the projection room should be laid out, using a standard type of stairs where necessary, but in no case permitting ladder approaches.

The supervisor should acquaint himself with all the pertinent regulations issued by local authorities and should see that these are complied with in the construction work. Planning the arrangement of the equipment within the projection room so as to obtain the most convenient operation is a matter of prime importance. For instance, if house-light dimmers and curtain control are included in the projection room, it should be possible for the projectionist to manipulate them while at his position beside the projector and while looking through his observation port.

The supervisor should concern himself also with the amount and the arrangements of the house lighting used during the picture, paying particular attention to the shading of these lights from the screen and from the eyes of the audience. The entrances to the auditorium should be so constructed that daylight will be excluded and can not possibly fall upon the screen. In order that those already seated be spared every distraction, the noise and movement of patrons entering the theatre should be screened as much as possible by the generous use of baffles and acoustic material.

The projection room should receive proper acoustic treatment to prevent the noise of projectors, monitor speaker, or conversations being transmitted to the audience. Observation ports should be glassed in, and projection ports stopped down to actual dimensions of the projected light-beam, and also lined with a suitable sound-absorbing material. All other ports should be so arranged that they may be kept closed when not in actual use. In short, no factor related to presenting the program to the audience should be considered as being outside the province of the supervisor, or to be disregarded by him.

● Periodic Inspections

Thorough supervision requires the making of periodical theatre inspections, on which occasions the supervisor would naturally look for any apparent screen faults, such as an unsteady picture, travel-ghost, uneven or poor screen illumination, scratched film, or oily film. He would, no doubt, obtain a great deal of information by observing the picture as projected on the screen. He should also note the condition of the picture screen.

Innumerable other details will require his attention, such as checking of projector components for vibration wear, adjustments and tensions imposed on the film; the noise levels of projectors; equalizing the sound and the light outputs of projectors; determining the overall frequency response of each sound channel; examination of arc voltage and amperage; inspection of feeding mechanism and lamp houses; examination of wire connections. fuses and switches.

Also, determining whether or not undue heat develops in any of these items or its connections; checking the condition of theatre reels, rewinders,



HARRY RUBIN

†J. Soc. Mot. Pict. Eng. (June 1940).

and film cabinets; checking the condition of projector gears, shafts, and bearings, their lubrication and cleanliness; checking the amount of backlash between the shutter and the intermittent sprocket; checking the condition of motor-generator brushes, brush rigging, commutator, bearings, end play of shaft, level position, lubrication, and cleanliness.

To list every possible fault which might develop in each item of equipment would serve no practical purpose here. A few of the most prominent points have, however, been listed herein in order to indicate the extensive inspection and checking required.

● Release Print Life

The supervisor will naturally direct his efforts to prolonging the life of release prints. Most instances of film damage can be directly attributed to lack of supervision, to having permitted equipment wear to develop to the point where damage to the film is inevitable, to faulty adjustment of projector parts, to excessive tension in the film or to plain stupidity concerning the handling of film.

Usually film is not taken out of service because the sprocket-holes have become so worn that the further use of the film would be hazardous. More frequently the film is retired because it has become so badly scratched and soaked with oil that its entertainment value has declined to the vanishing point. Scratching of film, together with the second notorious trouble, oiliness of the film, may be reduced to a minimum by seeing to it that the projectors are maintained in first-class condition and that the projectionists are thoroughly trained in the correct methods of handling the film during the projection and rewinding processes.

Supervision involves not only an effort to eliminate all possible defects in the equipment but also an attempt to reduce to a minimum the chances of mistakes in presenting the show to the audience. For this reason, it is essential that the supervisor initiate a routine which will include a complete outline of the duties of each projectionist, making certain that this includes some method whereby a reel can be readily identified *after* it has been threaded into the projector and before actual projection. A sticker carrying the name or the number of the reel attached to the film where it passes over the hub of the take-up reel is one convenient method of accomplishing this.

A word should be said regarding the supervisor's relations with the projectionists under his supervision. By his example and instructions he can promote higher standards and more careful work on the part of the projectionists. By giving heed to their reasonable requests, he can maintain their active cooperation in presenting perfect shows. Conversely, if requests for needed materials or repairs are ignored, it need not be wondered at if the projectionists soon develop an attitude of indifference.

Obviously, the supervisor can not be present in each theatre during all the hours of operation and consequently he must rely upon the cooperation of the regular projectionists in calling his attention to any undesirable condition in the equipment or in the performance which might otherwise escape attention. In connection with this, it is very helpful to enter a record of such instances in a logbook kept in the projection room for the purpose and available to be consulted whenever inspections are made.

Other helpful aids are written records covering spare parts, materials required, and (when they have been received) also wiring diagrams, which may be posted on the projection room wall, these indicating the size and the location of every fuse, switch, or circuit-breaker in the projection and sound feeders.

In checking up on theatres, it has been discovered that one of the most frequent defects which are found has been the misalignment of the projector light-source with the other components of the optical system. When this condition has been corrected it has resulted in greatly improved screen illumination.

In many localities theatres are obliged to purchase electric service from companies which in computing their rates take into consideration the maximum wattage (or "demand") used at any instant during the monthly billing period. Under such a system, the greater the maximum wattage used by the theatre, the higher the rate for each kilowatt hour. In such a situation it becomes doubly important to install equipment that will provide sufficient illumination on the screen and which at the same time will operate so efficiently that the wattage drawn from the power lines is held at a minimum.

In conclusion, supervision provides the only means the exhibitor has at his disposal to protect his most important asset, a reputation for giving high-quality performance. It is the only means available to him to protect his equipment against excessive deterioration and frequent breakdowns. It should not, therefore, be regarded as a needless expense but rather as an invaluable and indispensable necessity.

RECORDING GAINS FEATURE SMPE PROGRESS REPORT

The necessity for making the original recordings on 35-mm film with subsequent reduction to the 16-mm width no longer exists. During the last year numerous complete advertising productions were recorded directly on 16-mm film. Some were recorded by the negative-positive technic, while others, taking advantage of the improved quality of reversible films, made use of the somewhat longer method of making the original on reversible film and the prints on positive film from a dupe negative.

One of the most significant advances of the year in sound recording technics has been the adaptation of fine-grain films to variable-density sound recording. The interest in the use of these films for such work has been due to the possibility that they might offer an appreciable reduction of the background noise existing in present standard stocks. It was felt that a reduction in noise in the film itself was essential to accommodate fully the volume range obtainable in modern sound recording systems.

Besides tests on existing fine-grain emulsions, extensive investigation was made on several experimental films, which were developed especially for this purpose. With certain films, the use of an improved type of high-pressure mercury arc offered a satisfactory illuminant. It was also found that the standard tungsten lamp might be used as an exposure source with certain optical systems and under certain development conditions. An improvement in signal-to-noise ratio of at least 6 db was reported for a fine-grain print from a fine-grain negative.

Considerable improvement was also noted in overall quality when fine-grain film was used for the original negative, re-recorded print and re-recorded negative, with the final print being made on standard positive film. Improved image definition is also claimed to result, probably due to reduced flare in the emulsion. The results of this development are sufficiently encouraging that in spite of attendant difficulties, the introduction of the technic on a wide scale into the motion picture industry appears to be inevitable.

Two interesting methods of producing artificial reverberation have been described. In the first, the material to which reverberation is to be added is recorded upon a steel tape. A number of reproducing heads are separated by appropriate time intervals along the tape, so that when reproduced, multiple sources are obtained. The outputs are separately attenuated, thus simulating reverberation. The second method employs an electro-optical system. Here the material is recorded on phosphorescent material coated on the rim of a revolving turntable. The images are transitory, and by scanning the images at appropriate intervals, a time delay and decay in volume output from these image sources are obtained.

Altec man Roy Tyack recently delivered a short lecture on theatre sound equipment as part of a short course offered by the College of Engineering, U. of Oklahoma, for exhibitors and projectionists in that section.

RCA SOUND SERVICE TOOLS

BY RCA PHOTOPHONE ENGINEERING STAFF

SINCE the early days of sound motion pictures, the service branch of the industry has kept pace with the various developments and improvements in the art. In 1928 the field engineer was equipped with a minimum of tools and test equipment. In contrast, today he carries a complete set of modern service instruments and tools which comprise the following:

(1) Complete technical data on Photophone and equipment of other manufacturers; (2) Special Weston analyzer; (3) Special Weston power level meter; (4) Socket selector kit; (5) Tool kit; (6) Special wrenches; (7) Speed counter; (8) Loud speaker adjustment tool.

Also (9) Standard frequency test-film; (10) 7000 and 9000-cycle focusing films; (11) Lateral adjustment film (buzz track); (12) Push-pull test-film; (13) Academy dialog and music film; (14) Universal a.c. bridge for measurement of resistance, capacity, and inductance; (15) Cathode-ray oscillograph; (16) Beat-frequency oscillator, and (17) Emergency amplifier and speaker system.

The Weston analyzer, together with the power level meter and socket selector kit, incorporates a 20,000-ohm-per-volt meter with scales up to 1000 volts. In addition, provision is made for checking any range of current or resistance normally encountered in routine service work. The socket selector kit is designed for checking tubes in the amplifying equipment making it possible to test under dynamic conditions.

Since a 15-ohm output impedance has been standard on Photophone equipment for a number of years, the power level meter is calibrated for this impedance and a 12.5-milliwatt reference level. Charts are provided from which correction factors can be obtained when the meter is used on circuits of different impedance or when other reference levels are necessary. This meter is used in conjunction with the standard frequency film or beat-frequency oscillator in obtaining overall system frequency response or complete transmission runs.

The tool kit contains all the necessary tools for proper installation and service operation on the complete equipment. In addition there are special sound-head wrenches and motor alignment tools. A Starrett speed counter is included for accurately measuring film speed.

● Frequency Test Film

The present frequency test-film was designed to make it more useful in field work. Accordingly, identical tracks are recorded on each edge of the film, thereby eliminating the need for rewinding after each test. This greatly speeds up the work of taking response curves.

Thirty-three frequencies are included, from 30 to 10,000 cycles, with the 1000-cycle reference at the beginning and end of each track. Additional frequency recordings are included between 2000 cycles and 3000 cycles to provide a more comprehensive overall response test. The response is held within ±0.5 db throughout the frequency range. For adjustment of film position with respect to the sound-head light-beam, each engineer carries a small section of so-called buzz-track. The recording consists of two narrow chopper tracks so spaced that neither will affect the light-beam if the guide rollers are in proper lateral adjustment.

On the other edge of the film there is a 9000-cycle recording employed for focusing the light-beam on the film. The film is used in conjunction with an output meter to determine when the beam is correctly focused on the sound-track.

With the advent of push-pull sound-heads, it was necessary to provide a test-film for adjustment of the optical systems. This film consists of a 6-mil "septum" track on one edge for adjusting the division of the light-beam, and a 300-cycle track on the other edge, for correctly balancing the output of the dual photocell. The 300-cycle portion is also used to balance the output from each sound-head.

RCA field engineers are now equipped with the latest theatre sound test-reel produced by the Academy of M.P. Arts and Sciences.

To enable the field engineer to measure inductance and capacity as well as resistance, the RCA universal bridge (Fig. 1) is employed. This instrument is invaluable for checking reactors and transformers for shorted turns or other trouble, and for accurately determining values of capacitors. The measuring ranges are 100 μh to 10h, 10$\mu\mu$f to 10μf. and 1 ohm to 1 megohm. For higher values of resistance, the test analyzer is employed since this has ranges up to 10 megohms.

The instrument consists of a variable-ratio-arm Wheatstone bridge having three standards each of inductance, capacity, and resistance. A vacuum-tube 1000-cycle oscillator and a two-stage amplifier, together with their power supply, make up the major part of the equipment. The only additional equipment required is a "null" indicator, for which the power level meter is employed. Power is obtained from any 110 to 120-volt, 25 to 60-cycle source. The complete instrument weighs only 6 pounds.



FIGURE 1

Universal inductance, capacity, and resistance bridge



FIGURE 2

Cathode-Ray oscillograph

● Cathode-Ray Oscillograph

Another device which has been in general use for over three years and has proved extremely useful in theatre

service, is the cathode-ray oscillograph (Fig. 2). This instrument is probably the most versatile device yet developed for the study of radio and audio-frequency phenomena.

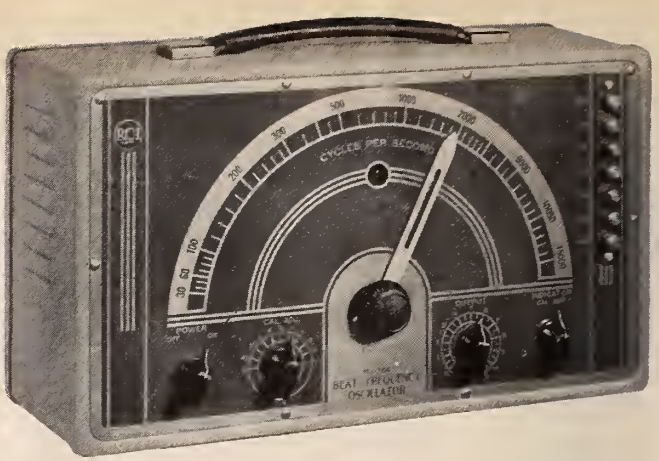
By means of the oscillograph the field engineer can quickly localize sources of hum in the sound systems and check hum patterns, determine where distortion is introduced, check phasing of networks, and perform many other routine checks which up to a few years ago were impossible to do. This instrument weighs 21 pounds complete and is entirely self-contained, requiring only a source of a.c. power supply.

For quickly checking the audio-frequency response and power output of a theatre sound system, the RCA portable beat-frequency oscillator (Fig. 3) is provided. This instrument is extremely rugged, weighs only 15 pounds, and is remarkably stable for its size. The hum level is 60 db below maximum output.

Besides its use in checking audio amplifiers, it is also extremely valuable for determining source of buzzes, rattles, *etc.*, in stage surroundings and auditorium fixtures. It is also used as a routine check on the loud speaker systems to be sure that the units are free from distortion.

FIGURE 3

Portable beat-frequency oscillator



● Portable Emergency System

In the latter part of 1936, RCA introduced a complete portable emergency sound system, so designated that it would be possible to keep the show running if every piece of equipment were down except one sound-head and projector (Fig. 4). This system proved so valuable that more than 150 are now located in theatres throughout the country, and besides this nearly every RCA field engineer carries one as standard equipment.

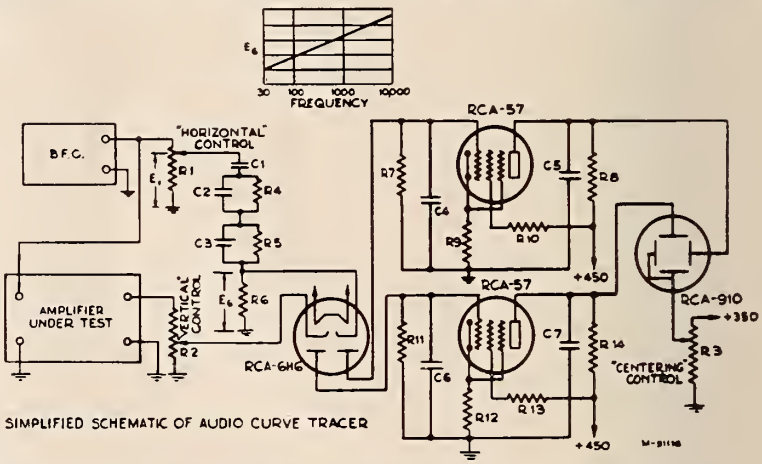
The most recent design incorporates many improvements for greater ease and simplicity in operation. The amplifier and all controls are housed in a small metal cabinet, with all necessary cables for making connections to sound-heads and stage lines. Sufficient audio power is available to carry even the largest theatre, and connections can be made to any type of sound equipment regardless of manufacture.

One of the recently developed special instruments is the audio curve tracer. This is a portable device which traces an amplifier response curve automatically on the screen of a cathode-ray tube. By using a tube with a long-persistence screen, such as the *RCA*-910, the image is retained long enough for it to be studied, photographed, or a second curve superimposed on it for comparison. With this instrument it is possible to run an accurate frequency response curve in approximately thirty seconds.

Figure 5 is a schematic drawing showing the operation of the instrument. The output of a beat-frequency oscillator is fed both into the "horizontal control" potentiometer *R*-1 and into the input of the amplifier under test. The voltage developed across *R*-1 is fed through a resistor-capacitor network to ground. The characteristics of this network are such that with a constant voltage *E*-1 impressed across the network, the voltage developed across *R*-6 varies directly as the logarithm of the frequency impressed. This is shown in the small curve above.

FIGURE 5

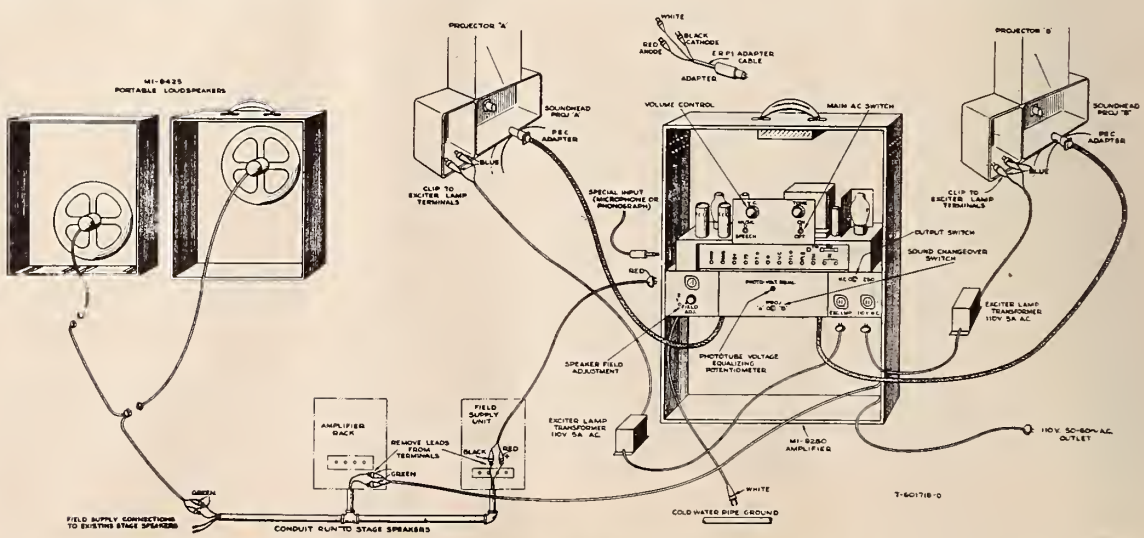
Audio curve tracer, simplified circuit

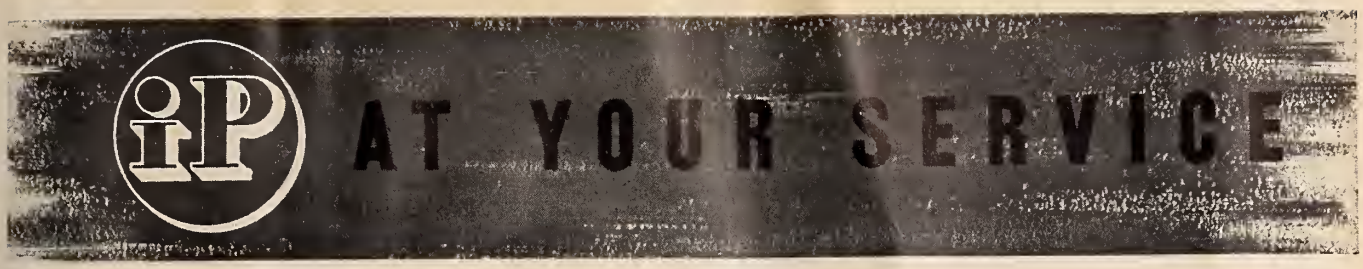


(To be continued)

FIGURE 4

Complete portable emergency sound system, PG-109-B





This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

THE oil shields installed in many W. E. type reproducer sets include a long celluloid "test tube" to collect the oil which drains from the shield. These oil collector tubes are held in a metal flange or holder attached to the oil shield, the oil tube being fastened at its open end by three clamping screws spaced 120° apart in the metal holder. The two rear clamping screws are often hard to get at for loosening when it is desired to remove the oil tube to empty the accumulated oil.

This difficulty of removing the oil tube can be overcome by filing two notches spaced 120° apart to coincide with the two rear clamping screws in the lip at the end of the tube. If this is done, the two rear screws can be left tight at all times and it will only be necessary to loosen the front screw when removing the oil tube.

The procedure in replacing the tube is to insert it in the flange holder past the two tight screws, letting the two screws pass through the notches in the lip of the tube. When the tube is inserted all the way it is twisted slightly so that the two rear screws no longer line up with the notches, and the front clamping screw is tightened. This little scheme makes unnecessary a lot of fussing which normally has to be gone through when emptying the accumulated oil from these tubes. —F. J. PFEIFF, *Altec, Conn.*

• • •

A quick method for checking loudspeakers is to feel the field structure after operation for several hours. Any speaker cooler than the average is probably operating with reduced field excitation, or none; this is particularly applicable to speakers like Erpi TA-4151, having separate power supplies; a weak rectifier tube can be easily caught. If the "tweeter" is operating, the field will be warm and placing a hand over the speaker mouth will result in a quite noticeable decrease of h.f. response and "hash".—P. V. SMITH, R.C.A., *Cleveland.*

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To hold a nut in an inaccessible place, fasten the nut on hacksaw blade with scotch tape and punch opening through tape for screw to enter. When the nut has been caught, the hacksaw blade can be pulled loose.—R. S. SEAR, R.C.A., *Pittsburgh.*

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It appears not to be commonly known that there is a right and a wrong way to align shafts which are coupled with Universal or Hooke's couplings which are used on many sound reproducers.

Encountering a case of severe machine vibration, I suspected that the drive shaft was causing the trouble. I tried various angles for the Universals, but none would eliminate the trouble. I brushed up on couplings in my book *Kinematics of Machinery* (Albert and Rogers) and found that there are three for the steady running of machinery through two Hooke's Universals. Where two Universal joints are used in a drive shaft, as is generally the case, complete compensation for drive irregularities introduced by the joints themselves is possible. Here are the requirements:

(*a*) The center line of the driving, driven and the intermediate (coupling) shafts, must be in the same plane or

(*b*) if the driving and driven shafts are not in line, the angle between the driving and the intermediate (coupling) shafts must be the same as the angle between the driven and the intermediate (coupling) shafts, and furthermore the forks of the Universal coupling halves on the ends of the intermediate (coupling) shaft must lie in the same plane.

The advantage of correct assembly and alignment of shafts becomes greater as the operating angle of the Universals increase. Not only is freedom from vibration effected, but also wear and life of the Universal joints.—V. A. CARPENTER, *Altec, Detroit.*

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The coupling rods running between the main volume control, or fader, and the auxiliary control at the second machine on many old-type systems are usually fastened by means of taper pins. These taper pins have a chronic habit of working loose and falling out at the precise time when a changeover is to be made or the volume adjusted. Later types use Bristow or Allen screws instead of taper pins, but this improvement cannot be readily adapted for the earlier models unless the holes for the taper pins are reamed and threaded, which is a bother.

If you have this kind of trouble, stop trying to hammer the taper pins tight. Remove them and insert a cotter pin. Cotter pins are easy to install and above all, easy to remove should the need arise. And once you put them in, they won't fall out.—W. B. ESSEX, *Altec, New York.*

• • •

A case of an unsteady projected picture was recently encountered in which the intermittent sprocket looked like new and in operation seemed to stand rock-steady. A knife blade revealed that each sprocket tooth was worn, not at the base but a couple hundredths of an inch up the tooth. The film sprocket holes, therefore, at times rode the normal base of the tooth and at others slipped into this groove with a resultant jumpy picture.—A. F. SCHNEIDER, R.C.A., *Kansas City.*

• • •

On many rheostats, especially wire wound rheostats in filament circuits, it is possible to remove the resistance strap from the bakelite holder and reverse it so that a practically new surface is contacted by the wiper arm. This will often be found to be of advantage when a rheostat becomes noisy because of loose or worn windings.—F. J. PFEIFF, *Altec, Conn.*

• • •

During the hot summer months don't forget that your sound system amplifiers can benefit as much from the breeze of an electric fan as you can. In very hot weather all types of electrical failures increase materially over comparable winter operation, statistics showing that condenser and resistor troubles in some types of equipment will more than double during the summer period.

Electrical apparatus generate internal heat when in operation due to current flow through the inherent resistance. Heat tends to break down the insulation in condensers and transformers and in fuse wiring. The ability of such apparatus to withstand breakdown is limited by its ability to radiate this heat into the surrounding air. Electrical apparatus is generally designed and approved for operation in maximum ambient temperatures of

120°F, 140°F, *etc.* When these temperatures are approached in summertime (with the added emphasis of a stifling projection room) the safety margin designed into the equipment is reduced.

Conversely, during the winter there is an appreciable drop in electrical failures due to internally generated heat being more readily dissipated into the cooler surrounding air.—T. H. CARPENTER, *Altec, New York.*

• • •

Frequently when a projectionist attempts to take a lens assembly apart for cleaning he finds the various sections of the lens barrel screwed on so tightly that they cannot be taken apart without undue force. The lens barrel is usually a bit oily, so a person cannot get a good grip on it to twist. Take a turn on each side of the joint with a couple pieces of ordinary friction tape, and you will have no trouble unscrewing the assembly.—E. A. DOYLE, R.C.A., *San Francisco.*

IT DOES not seem to be generally known that a stiff intermittent movement, or particularly one with a bad "high" spot, will place such a load on some projector drive motors that the machine will not start.

A recent emergency call was due to this trouble. No difficulty was experienced in starting the motor if the intermittent was in any position except the one point where a high spot existed; but when the machine stopped on this one spot, which seemed always to occur, the motor did not have sufficient surplus power to turn over on the next start.

Many of the older style drive motors, particularly those with trick regulating circuits, do not have any power to spare. Thus, it is very important to see that the projector intermittent, as well as all of the mechanical system, rotates freely in order to make sure that the machine can be started.—C. W. SCOTT, *Altec, St. Paul, Minn.*

• • •

Here's another method for taking apart projection lenses for cleaning. Use a rubber ring, such as sold in hardware stores, for opening Mason jars. This ring has a serrated inner periphery which makes an ideal wrench for lenses.—R. S. SEAR, R.C.A., *Pittsburgh.*

• • •

The cleaning of motor brush caps and certain types of vacuum tube socket contacts can be done well with a Klenzo ink eraser pencil. This coarse rubber eraser is effective in removing oxidization and will give a clean shiny contact surface.

However, to do a better clean-up job in less time, a short section of the eraser can be placed in a "Handy" chuck and used in a small high-speed electric grill. The results when used on brush caps and burned socket contact is amazing. It permits mass production burnishing in those older style equipments which have a large number of motor brush caps and vacuum tube sockets.—R. S. MERCHANT, *Altec, Detroit, Mich.*

• • •

There are still a number of speakers having built-in a.c. tube rectifiers which have been in use for quite a time, and it is a good thing to make a quick check on the filter condenser in the field supply. If this condenser is open, as was found recently in three cases in my territory, there will be a noticeable hum in the speaker.

To check for open condensers it is only necessary to "short" the speech leads to the speaker. If there is a noticeable hum, it is due to improper filtering of the field supply which is picked up by the hum bucking coil.

It is not necessary to go backstage to make this check; merely "short" the speech leads in the projection room, then step out in the auditorium and listen for hum. If there is hum present, it is of course necessary to go backstage to single out the offender.—C. E. MAASS, *Altec, Boston.*

• • •

Oil shields between the projector and its soundhead may be made more effective by sealing the holes in the oil shields through which the projector mounting bolts pass. The mounting bolts should also be sealed as oil will follow down the threads of the bolts.

A good non-hardening gasket sealer should be used, such as "Gasket-Goo No. 1" or "Permatex No. 2". Be sure to use a sealer that will not harden.—M. E. WHEATON, R.C.A., *Boston.*

• • •

It is possible to make temporary repairs to gears in which several teeth have been stripped and save a show. A hole should be drilled radially in the base of each stripped tooth about ⅜" deep and of such diameter that a nail or taper pin will drive fit into it. The pins should then be driven into the holes and cut off to the tooth height. Then the flanks can be filed to match the tooth contour.—D. W. WADDELL, R.C.A., *Boston.*

• • •

An unusual method for cleaning out the mess which collects under strippers is as follows: A short strip of film is hooked onto the sprocket, at the back side of the stripper, and the projector then turned over backward by hand. This carries the film through the space between the sprocket and stripper, and effectively cleans it as well as and much quicker than by removing the stripper.—P. C. MCGAUGHEY, R.C.A., *Boston.*

• • •

An easy method for determining and localizing vibrating and noisy parts of a machine is to hold the tip of a screwdriver tightly against the suspected part. Then the ear is placed against the handle. If any vibration or noise is present it is easily detected, since the screwdriver transmits such vibrations directly to the ear drum.—M. D. FAIGE, R.C.A., *Boston.*

FREQUENTLY a projectionist or theatre maintenance man is faced with the necessity of fastening seats, spot lamp base, motor or compressor base, or some heavy articles to a concrete floor. If expansion bolts have already been used and pulled out, it is useless to try to use others, because they won't hold. Often a hole is drilled in the concrete, the bolt set in place, and hot lead poured around it. In one case out of a hundred this results in a satisfactory job, but seldom more frequently. "Smooth-on" is some times used with success, instead of the lead. However, "Smooth-on" is expensive and slow to work.

The best solution is sulphur. It is cheap, works easily, and will hold any load. Hole is drilled in the concrete with a star drill, the bolt set in place, and melted sulphur poured in the bole. Tbe sulphur seems to get a better hold onto the concrete than lead. Use plain, bulk sulphur, and heat it just enough to bring it to the melting point.

Excessive heating or reheating it after it has reached the melting point and allowed to cool, will occasion some chemical reaction that will cause it not to hold; so for a good job, have the holes ready, bolts in place, then melt the sulphur and pour it in. A pound of sulphur will fasten many a bolt, and bulk sulpbur is cheap. It is not disagreeable to work and fumes are not bad.—W. S. GILREATH, R.C.A., *Dallas.*

• • •

A handy cue marker, which is particularly useful for subsequent run films where the standard cues have been mutilated, can very easily be added to any Standard Griswold Film Splicer. The writer has used this method for several years and found that not only is it quick and neat but also very convenient. The cue appears on the screen as a small white circle the size of the standard cue and in the same relative position.

The method consists simply of drilling three ⅛" holes in the upper left hand film holder of the splicer in such a manner that when the holder is closed on the film the holes will be in the correct position for scribing the cues. The scriber is made by filing a V in the end of a knurled headed screw such as used on amplifier panels of the PG-91 variety. If care is exercised in filing the V to a sharp clear cut, the cue on the film will be well formed and clear when the scriber is turned in the guide holes.

In order to properly locate tbe guide holes to be drilled, a piece of film with the printed cues can be used as a template by positioning it in the splicer in such a manner that the tbree dots will be directly under the left film holder. Then by prick-punching through the cue dots the exact position for drilling is obtained. This cue marker bas met with approval because of the simplicity and convenience with whicb uniform cues can be made.—F. M. ARMSTRONG, R.C.A., *Baltimore.*

[*This description is suggestive of the Clint Phare Signo-Marker recently described in these columns.*—ED.]

THEATRE SOUND SYSTEMS STANDARDIZATION PROGRAM

(*Continued from page* 20)

office because of poor quality and improper sound level.

● Voltage Regulation

A common difficulty leading to fader changes within a single feature is poor regulation of the power supply to the theatre, *i.e.*, the incoming A.C. line voltage from the power company's supply line varies from time to time. In many instances the change in line voltage is sufficient to vary the acoustic power in the auditorium as much as 400%! It is advisable in all installations where perfect line voltage regulation is not available to install a voltage regulator as part of the sound equipment. This voltage regulator will maintain a constant voltage to the equipment and thus a constant power level in the theatre regardless of wide line voltage variations.

In the early days of sound, each producer made his product to conform to his own individual standards, thus necessitating constant adjustment by the service man as the theatre ran the product of different studios. At the present time you will find a much greater degree of uniformity between product than four or five years ago, and we are all continually striving to remove any differences still existing and to eliminate the necessity for any adjustment of theatre equipment to fit individual product.

DISCUSSION:

Q. What effect does the number of people in the theatre have upon the loudness level and upon the wattage capacity of the installed equipment?

MR. HILLIARD: The number of people in the theatre affects the loudness level in two ways: One, the theatre noise level increases with increased audience attendance; two, a large audience absorbs acoustical power. It is often necessary to raise the sound level a fader step or two to compensate for increased audience noise as the auditorium fills.

A large audience absorbs acoustic power. However, where a theatre has acceptable acoustic properties, including acoustic material on the walls, rugs covering the floor, and seats with a considerable amount of soft cloth covering, the loudness level in the auditorium will not vary appreciably between the time the auditorium is empty and when it is filled.

Conversely, where the theatre is abnormally reverberant when empty, three or four times as much power may be required for the same loudness level with a large audience present. In such a case, unless the difficulty is remedied at the source, that is, by proper acoustical treatment of the auditorium, it will be necessary to let experience dictate the manner in which this deficiency should be compensated for. This consequently represents a problem with which the theatre manager must cope.

Concerning the effect of the audience on the installed wattage in the theatre,



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this fact was considered when the minimum power requirements were prepared. These requirements were based on a series of measurements in a large number of theatres with an average audience in attendance. Consequently, power installed according to these recommendations will be adequate under the most severe audience condition.

Opinion on Stereophonic Sound

Q. Could you give us any information on the status of stereophonic sound?

MR. HILLIARD: The idea in itself has been known for several years. As early as 1933 demonstrations of stereophonic sound reproduction were made. The equipment consisted of three completely separate pickup systems, that is, with independent microphones and amplifiers each pickup system supplying separate loud speakers. Thus, three distinct pickup and reproducing channels were used. the sounds from the different channels being separate until they were acoustically mixed after leaving their respective loud speakers—the result giving an effect of three-dimensional sound. Since that time a number of such demonstrations have been made.

More recently stereophonic reproduction of sound-on-film has been used. In this case, three separate sound tracks are recorded which are then reproduced on three separate horn systems. Since added equipment is involved in the application to the theatre of stereophonic sound, it would appear that at best considerable time will elapse before any production could be generally released in this manner.

Undoubtedly from time to time more stereophonic demonstrations will take place, and it is quite probable that in special cases productions may be so recorded for a *very restricted release.* However, no immediate wide scale production of this type is planned because of insufficient experience on the subject.

For those interested from the standpoint of current equipment problems, we can safely say that any equipment currently or recently purchased can be utilized as part of any future stereophonic installation by an addition to, rather than a substitution for, this original equipment. In other words, the new development will not make current equipment obsolete.

Q. How can I tell if a variation in line voltage is the cause of variation in sound level during the showing of a feature?

MR. HILLIARD: Your sound service man will be glad to borrow a recording type voltmeter from your local power company to determine just how much the voltage varies during the show. From the measurements he can determine what is necessary to correct the condition.

Theatre Amplifier Ratings

Q. Has the Research Council issued any information on the manner in which amplifiers for theatre sound equipment should be rated?

MR. HILLIARD: On April 2, 1938, the Council sent out to manufacturers, service organizations and other interested people a Bulletin, containing the following specifications on sound equipment amplifier rating:

"*Distortion: At its rated output the amplifier shall not generate more than 2% total harmonic in the frequency range from 50 to 5,000 cps. Amplifier output is the average power into the specified resistance load when the amplifier is excited with sinusoidal input signal. The harmonic content is defined in terms of a ratio of currents between the root mean square sum of all harmonic components and the fundamental.*"

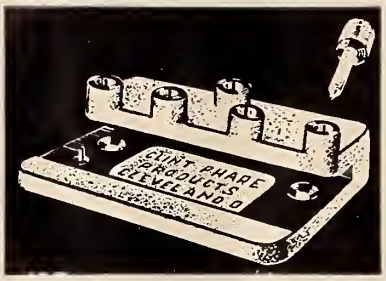
Q. In your recommendations on the output rating on various amplifiers, do you take into consideration the maximum output or the undistorted output?

MR. HILLIARD: The answer to this question is included in the recommendations quoted in reply to the previous question.

Q. Has the efficiency of the speaker system been given consideration in your power requirements?

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MR. HILLIARD: Yes, this factor has been included in our minimum power requirements and these requirements hold only for loud speakers having an efficiency greater than 25 per cent.

Q. What per cent of the amplifier power is absorbed by the monitor horn?

MR. HILLIARD: Our minimum power requirements specify that the rated wattage be available when the monitor volume control is set for maximum loudness. We recommend that a special monitor amplifier be included as part of the equipment, so that at no time does operation of the monitor horn effect the loudness of the sound in the auditorium.

Q. Do permanent magnet monitor speakers lower the efficiency of the amplifiers?

MR. HILLIARD: Since an isolation amplifier is recommended between the monitor horn and the auditorium horn, the type of equipment used in no way changes the efficiency.

Hard-of-Hearing Set Power

Q. Have you made allowance for the effect on the volume level of the hard-of-hearing sets?

MR. HILLIARD: Yes, allowance for the power requirements of the hard-of-hearing sets has been taken care of in the same manner as the monitor horn. In this case also a separate amplifier is recommended so that the total rated wattage of the amplifiers will be available for auditorium use.

Q. If in the recommendations it would be specified that the hard-of-hearing sets absorb no power, what would you recommend concerning the acoustical interference from these sets?

MR. HILLIARD: The amount of acoustical interference from hard-of-hearing sets varies with the type of headset used, the manner in which the set is attached to the head, and the degree of deafness of the user. Obviously, where a person is extremely hard-of-hearing the maximum volume will be used, and acoustic interference will be present unless the hard-of-hearing sets are so adjusted that the maximum amount of power available the acoustic interference is reduced to a tolerable amount.

Q. Are you voicing a complaint that the field has not been careful enough of their theatres?

MR. HILLIARD: No, quite the contrary. The Theatre Sound Standardization Committee has realized that the exhibitor is always interested in raising the quality of the sound in his theatre, and also has realized that one of its functions is to reach the exhibitors with proper technical information and advice.

Q. About a year ago I was in the market for a new sound system for a theatre with 800 seats. One manufacturer wanted to sell me a 20-watt system and another manufacturer a 35-watt system. Was 20 watts adequate for my theatre?

MR. HILLIARD: The information requested is contained in our "Minimum Power Requirements for Theatres," and provides a specific example of the type of technical information which is available to the exhibitor through the Council. Due to a lack of communication between the Committee and the exhibitor, this information was not available to you when you needed it. In this case, if you had had our information at hand or had written to us for such information, you would have immediately known that the 20 watts

decided upon was more than adequate.

Q. Is there equipment available to reduce background noise?

MR. HILLIARD: The subject of background noise has been of concern to the studios since the inception of sound. In the earlier years the so-called surface or ground noise was of such magnitude as to be objectionable and a source of distraction to the listener. In more recent years this type of noise has been reduced to the point where the listener is very seldom aware of its existence.

Although it is possible by adjustment of the theatre equipment to reduce background noise, such adjustment is not recommended as it also sacrifices "intelligibility" and "presence" on the screen.

Cause of 'Motor-Boat' Noise

Q. What causes the "motor-boat noise" often heard in a theatre?

MR. HILLIARD: This so-called "motor-boat noise" is a specific example of improper adjustment of the equipment. The film is allowed to move laterally in the sound head to such an extent that picture frame lines are reproduced along with the "wanted" sound. The reproduction of these picture frame lines results in a sound which occurs 24 times per second, and the term motor-boating is derived from the fact that it sounds very similar to a motor-boat exhaust. Proper adjustment of the sound head will eliminate this effect.

Q. In what manner may the efficiency of theatre sound systems be determined over a period of time? By this I mean the loss of quality and volume over a period time.

MR. HILLIARD: Since theatre reproducing equipment consists of vacuum tubes, exciter lamps and associated electrical and mechanical equipment, gradual deterioration must take place. This change is usually so slow that the average non-technical person is not aware that it is taking place until an extreme condition has been reached or until complete sound failure occurs.

Consequently it is very desirable to have proper technical inspection of the equipment at frequent intervals, so that this deterioration will not reach proportions which seriously effect quality or lead to failure of the equipment.

Q. Has the Research Council given consideration to Television and its effect upon the industry?

MR. HILLIARD: The Academy Research Council has a standing Committee on Television, which issues an annual report. The current report is now in the process of preparation and copies will be available upon request. In addition this Report will be widely printed in all of the trade magazines.

SOUND REENFORCING DATA

(*Continued from page* 12)

and excessive installation expense, RCA engineers designed and announced electric mixing equipment and control circuits now so popular in modern reenforcing systems.

The main component in electric mixing is the small single-stage input signal mixer amplifier unit, simply attached to the main amplifier, essentially taking the place of the conventional separate microphone amplifier. Each microphone feeds directly into one of these units. The output level of the unit may be varied at will by an ingenious variable bias control located either at the amplifier or at any other desired point.

This control is noiseless and, inasmuch as it is not connected in the sound signal line, no insertion loss of level is experienced nor is it susceptible to stray field A.C. hum pick-up. This means that the installation of such remote mixer controls (preferably in the rear of the auditorium) does not require shielded lead cables, thus greatly reducing installation cost. Similar circuits may be arranged so that the master control of the overall volume level is likewise located with the remote microphone mixer controls.

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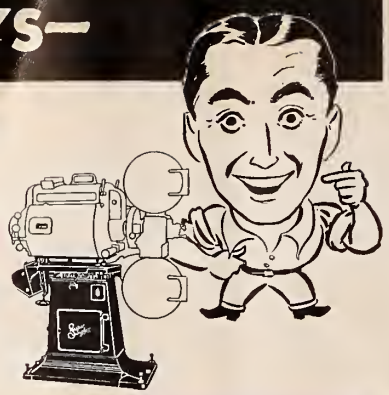
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and master level controls cannot be overemphasized, for the success of the performance truly rests in the hands of the mixer operator. Through the wrong setting of several microphone levels, the delicate balance between instruments of a great orchestra may be destroyed, or the overall volume may be so excessive as to approach the very uncomfortable stage of feeling. Those responsible for mixing and volume should be thoroughly familiar with all microphone positions and corresponding mixer controls. Each program should be completely rehearsed to insure a natural smoothness to the entire performance.

● Summary of Requisites

In summarizing this discussion, the need for sound reenforcement is very evident in most every theatre today, whether it be in the movie house for Bingo or ballyhoo, or in the legitimate show where players uselessly try to make themselves heard throughout the entire house. The high degree of perfection existing today in sound picture entertainment has made the public very sound conscious and they demand the same degree of hearing enjoyment from events actually taking place on the theatre stage. Sound reenforcement is the answer.

Some general hints for improved operation of reenforcing systems have been purposely omitted from the foregoing discussion, so that they might be more emphasized in conclusion, and are hereby listed:

1. Select a position for the microphone so that the direct path between announcer and audience is unobstructed.
2. Avoid placing the microphone too near a reflecting surface.
3. Select a position for the loudspeakers so that the microphones are behind the speakers.
4. Use a velocity microphone no closer than 18 inches to the mouth.
5. Refrain from purposely blowing on the ribbon of a velocity microphone, as such will probably damage the unit.
6. Set the overall volume control well below the acoustic feedback level.
7. Set the compensation controls to obtain clear articulation when speech is reenforced, but with full available frequency range for reproduction of music.
8. Provide suitable dust covers for all microphones not in use, especially those units mounted in footlight troughs.
9. If it is necessary to turn off the system in order to detect its operation, the highest degree of perfection has been attained in sound reenforcement.

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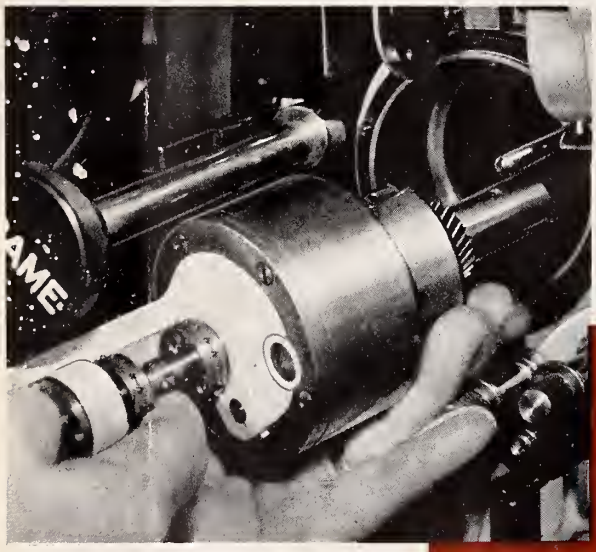
Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

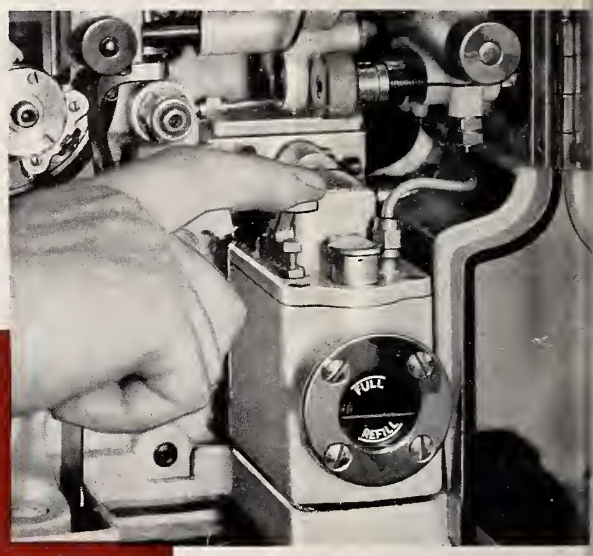
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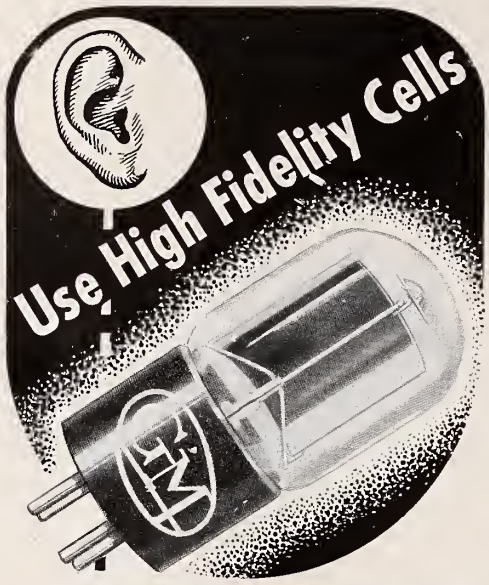
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OCT 30 1941

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 15 JULY 1940 *Number 7*

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Monthly Chat

IN THIS issue a goodly cargo of material anent which we have made several promises but on which, through no fault of ours, we were unable until now to make good. Dr. Rayton spills the dope on the new series of Cinephor *f*/2 lenses, coated and uncoated, and thereby disperses the mist which has clouded the facts concerning this latest advance in projection optics. From not so merrie England has arrived the discussion incident to the paper on high-brightness mercury vapor lamps which appeared in our March issue. These observations serve handsomely to clear up some of the more vexing questions apropos this new light source.

The aforementioned data merely leads the parade of informative and interesting information about the projection process and its practitioners.

• • •

One comparatively recent development in the projection field has not had the attention paid it which its importance merits. We refer to the possibility—nay, probability—that not a few manufacturers of projection and other theatre equipment may soon find themselves "co-operating" with Uncle Sam in that revered gentleman's precipitate rush toward the maximum degree of rearmament possible. We know positively that International Projector Corp. is already well along on several armament contracts; and Bausch & Lomb is a "natural" for this sort of work. At least three other manufacturers in this field have been "approached" by the Government on the basis of "availability when the time comes".

All of which should lead up to a point where serious consideration by the field on the score of a possible shortage of complete units and parts therefor is in order. We can visualize a day not far in the future when certain theatres will be forced to close down, and the operation of many others jeopardized, by an acute shortage of parts for projectors, sound equipments, lamps, or what have you.

The smart projectionist will act upon this situation *now* by tipping off the boss as to the possibilities of serious loss inherent in such a setup. The boss may not go for the canvass the first time, but constant hammering on the point by the projectionist undoubtedly will effect the desired result.

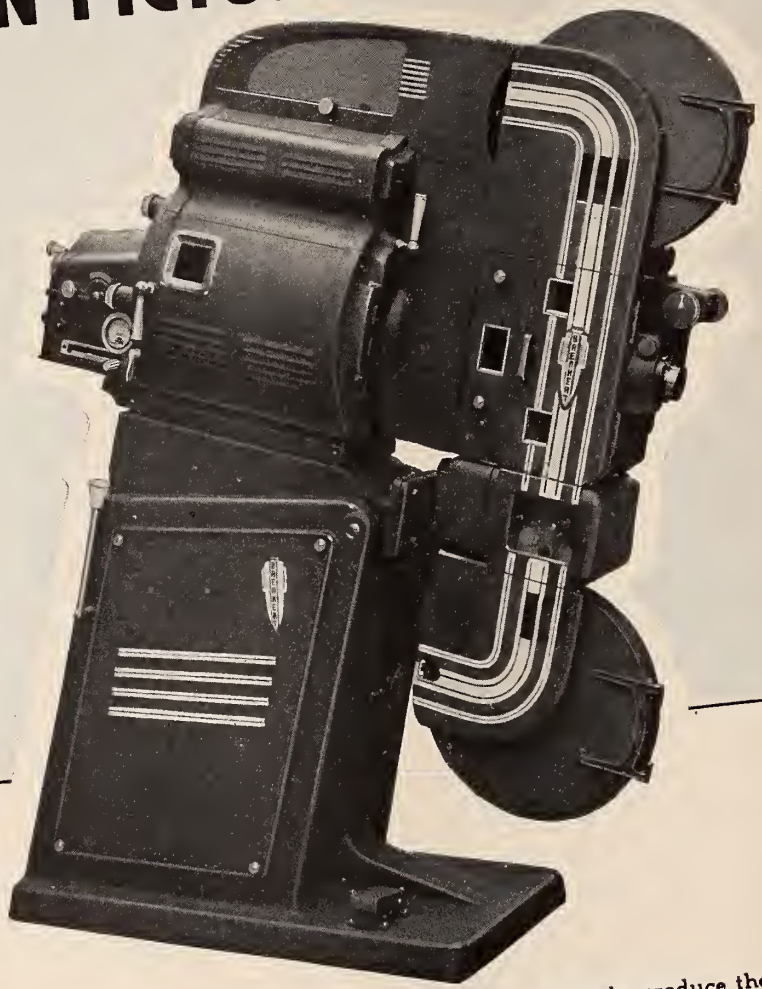
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INTERNATIONAL PROJECTIONIST

VOLUME XV JULY 1940 NUMBER 7

New Lenses For Projecting Motion Pictures†

By *Dr. W. B. RAYTON*

SCIENTIFIC BUREAU
BAUSCH & LOMB OPTICAL CO.

SINCE the early days of the industry, motion picture exhibitors have usually been searching for increased illumination. Among the reasons that at various times have led to this demand have been a desire for larger picture sizes, the introduction of perforated screens with a consequent reduction in reflectivity, the use of low key-lighting in the studios, and the growing use of color.

The equipment manufacturers have constantly striven to satisfy the needs of the projectionist and the history of their activities consists of a constant series of improvements in sources of light, lamp houses, the optics of the illuminating system, and in projection lenses. This paper is offered to put on record two new series of projection lenses which constitute another step in this long record of advancements in equipment design.

● The Super Cinephor f/2

Both series are made with a relative aperture of *f*/2.0. It is to be understood that no claim is made that this is the first time that projection lenses with a relative aperture of this size have been made. In fact, lenses of considerably higher apertures have been made, although to what purpose it is difficult to see, if considered for theatre projection with an arc lamp as the source of light.

The first series is called the Super Cinephor *f*/2.0. It is available in focal lengths from 2 to 5 inches for use in theatre practice. Focal lengths of 6, 7, and 8 inches are also available, but can not be used on existing projectors because of the limitations of the lens holder. They are made primarily for use in background projection in motion picture studios. These lenses are anastigmats, which is to say, they are simultaneously corrected for astigmatism and for curvature of field.

Speaking before the S.M.P.E. in 1927, and commenting on a tendency that seemed to be developing at that time of building theatres with short projection distances and large screens, I made the statement that this tendency seemed likely to compel the use of anastigmat constructions in motion picture projection, but that if this result followed, it would be possible only by reducing the relative aperture of the projection lens or accepting a lower quality of definition over the whole picture area.

In spite of this somewhat pessimistic view, in three years we had designed and made available an anastigmat with a relative aperture of *f*/2.3 which was faster than the majority of projection lenses then in use, whose central definition was at least equal to anything in use at the time, and with greatly superior definition at the margin of the field. This was the *f*/2.3 Super Cinephor, undoubtedly the finest lens that had ever been offered up to that time for the projection of motion pictures. Because of its complex construction and the dense barium crown glass used therein, the light transmission was considerably less than that of lenses of the Petzval type commonly in use. In spite of this handicap, acceptance of the lens exceeded our expectations.

Nevertheless, we did not feel satisfied to let the matter rest at that point, but continued with experiments looking toward a new design with still greater relative aperture and employing glass of higher transparency. The result is a lens of the type shown in Fig. 1, in which the crown elements are made of light barium crown glass of high transparency and in which the corrections have been perfected for a

Herein are the answers to many of the questions anent the new series of lenses recently introduced by Bausch & Lomb which have been agitating the projectionist craft. The reasons underlying the startling results achieved by these new lenses, including the coated Super Cinephor f/2, are set forth clearly and succintly by an acknowledged expert on projection optics, whose observations should go far toward dispelling the myths anent this equipment which have had wide circulation.

† J. Soc. Mot. Pict. Eng. (July, 1940).

relative aperture of $f/2.0$ to such a point that an image of unimpeachable quality over the whole area of the screen is produced.

● Anti-Reflection Treatment

At just about the time we were ready to announce these lenses, experiments which had been going on in various parts of the country on anti-reflection treatment of glass surfaces had reached a point where it seemed practicable to incorporate such a feature in the lens in question and thereby obtain a very substantial increase in its light transmission and, consequently, in the brightness of the projected image. Release of the lenses was therefore held up in order to permit the surface treatment to be incorporated.

Experiments were conducted in motion picture theatres in order to satisfy ourselves reasonably well as to the durability of the surfaces in service. These experiments seemed to indicate that there was no reason to question their permanence, except that the results of the usual method of treatment will not stand the cleaning process as ordinarily employed on lens surfaces.

In order to overcome the possible difficulty offered by this condition, we have gone a step farther and have sealed the lenses air-tight so that they neither need to be taken apart for cleaning nor can they be taken apart except at the factory. This leaves all surfaces completely protected against dust, moisture, and oil vapor, except the outside surfaces. The treatment applied to the outside surfaces is, however, such as to make it possible to clean them in the ordinary manner. Fortunately, the glass employed in the construction is one of the few that permits an effective treatment in this way.

The question naturally arises as to how much increase in illumination may be expected from these lenses. It is impossible to answer this question in such a way that it has a definite meaning for any particular installation. We can make some assumptions, however, and on the basis of those assumptions state what may be expected.

If we assume that the basis of comparison is a lens of relative aperture of $f/2.4$, a lens of the same type with a relative aperture of $f/2.0$ will transmit 44 per cent more light, assuming that the aperture is completely filled by the illuminant. The effect of surface treatment is to provide a further increase of illumination of from 25 to 30 per cent.

● Comparative Transmissions

Because of the fact that it has eight air-glass surfaces as against 6 in the ordinary Petzval type of projection lens, the light transmission of the $f/2.0$ Super Cinephor will be about 88 per cent of the transmission of the Petzval type of lens such as, for example, the Bausch & Lomb Cinephor lens. If we assume 27 per cent as the average gain in transmission due to surface treatment, then, combining all factors, the *treated* f/2.0 Super Cinephor should show a gain of 61 per cent over an $f/2.4$ *untreated* lens of the Petzval construction.

This can be realized only if the illuminant is competent to utilize all of the aperture of the lens. Such illuminants do not exist. Some of the high-intensity reflector arcs, however, are competent to utilize a relative aperture of 2.2. As compared with an $f/2.4$, this represents a gain due to aperture of 19 per cent. Combining this with the gain due to surface treatment and the 12 per cent loss due to increased number of air-glass surfaces, the resulting possible increase still is 33 per cent with reference to a Cinephor lens of a speed of $f/2.4$, and at the same time this is accomplished with a flatter field of view.

● Less Glare, More Contrast

In addition to the increase of brightness of the projected image, experience has shown that the surface treatment has a further beneficial effect in the reduction of veiling glare and increasing the contrast of the image. Projectionists who were given experimental lenses for trial unanimously and voluntarily reported increased contrast and apparently improved sharpness of definition. The latter can not result from any actual reduction of aberrations, but must be the effect of improved contrast.

It is well known that any stray light on the screen will result in a loss of contrast. In untreated surfaces, light is reflected from each air-glass surface back toward the light-source. Some of this light is again reflected by other surfaces toward the screen. Another fraction of the light reflected back to-

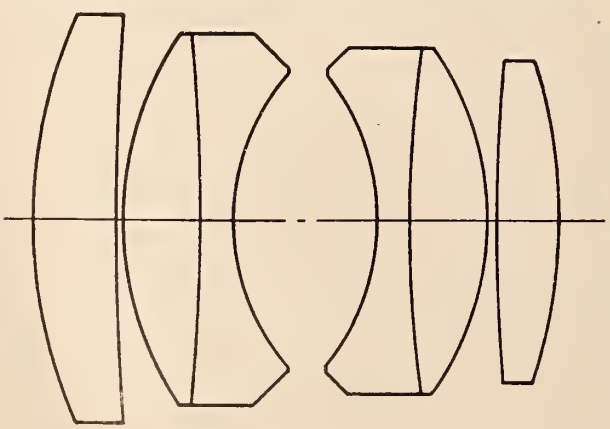


FIGURE 1

Advanced design is reflected in the new Super Cinephor 5-inch, f/2.0 lens.

The Advantages of a Three-Projector Room

By *M. D. O'BRIEN*
PROJECTION DEPT., LOEW'S THEATRES

THE necessity for a third projector does not arise until some unforeseen circumstance forces one of the active projectors out of service. Its primary purpose in such circumstances would be to maintain an uninterrupted show. Also, when the necessity arises for repairing one of the active projectors—in the ordinary routine which should exist in every well regulated projection room—the third projector becomes the *active* projector.

Of course, safety considerations are not confined to the projector mechanism but to all associated parts that go into a complete motion picture projector, including the source of illumination, sound parts, takeups, *etc.*

The third projector also performs another useful task in those theatres which go in, in a large way, for special effects. For instance, after it is decided to emphasize a certain portion of a picture to enhance dramatic effect, such as the well-known Magnascope, this portion of the film may be removed from the print and the third projector may be so set up that this effect can be projected on the screen without interference with the regular projectors.

● Security, Lessened Wear

Utilization of a third projector imparts to the crew a sense of security by reason of assurance that no serious interruption to the performance is likely. It also affects the maintenance problem by spreading the wear of the mechanisms over a longer time than required by two mechanisms, thus increasing the useful life of all three by at least 33 1/3%. Such a condition over a period of several years automatically tends to liquidate the initial payment of a third projector.

Looking at the sound picture  ***from the projectionist's port-hole***

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More than 600 Mid-West circuit theatres—including Balaban & Katz and Minnesota Amusement Co.—have been using Droll Patented Process carbons for 2 years—with complete satisfaction.

THE Droll Carbon Process is the first such to win complete acceptance by both projectionist and exhibitor—the former because it is the only such process to render absolute safety and satisfaction without requiring any extra work; the latter because it positively saves a minimum of 20% of his carbon bill.

Droll Patented Process carbons are now available to users of the following carbon trims:

SUPREX CARBON TRIMS

Negatives	*Positives*
6 mm. x 9	6 mm. x 12
6.5 mm. x 9	7 mm. x 12
7 mm. x 9	8 mm. x 12

AND the 13.6 mm. x 22 High-Intensity, machined for adapters only.

By the Droll Process, a carbon is so drilled on one end as to make a female opening; the other end is drilled for a male opening. The projectionist need only join the carbons together and clip them with a metal sleeve of pure copper —the same as the outside jacket of the carbon.

ALL DROLL PROCESS CARBONS REACH THE PROJECTION ROOM FULLY PREPARED AND READY FOR USE.

†U. S. Patent 2,120,243.

When the positive carbon is about 3 or 4 inches long, you simply insert the next carbon in the milled-out part, slipping the copper sleeve over the stub. This copper sleeve matches exactly the copper coating on the carbon. That's all there is to it—simplicity itself.

Although burning the carbon to about ½ or ¾ inch from the connection is recommended, it is possible to effect continuous burning with slight extra care.

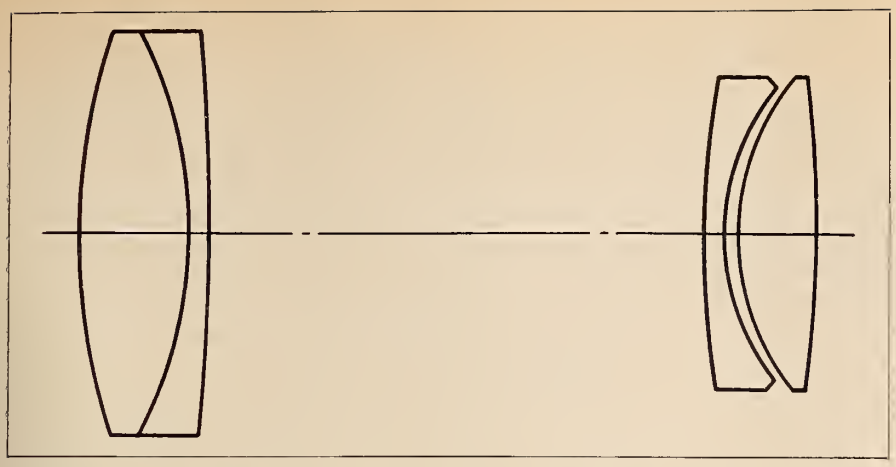
So pronounced has been the success enjoyed by this sensational new process that we invite all projectionists to try this type carbon. It will convince you of its absolute efficiency, ease of handling—plus at least a 20% saving. Write us today.

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Division of J. W. DROLL COMPANY

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351 East Ohio St. Chicago, Ill.



ward the source falls upon the film and by it is again reflected forward and reaches the screen. Both of these result in a certain amount of light appearing in areas that should be black. Reducing the amount of reflection has a very decided effect in improving the general appearance of the projected image.

We believe that the lens just described represents the highest point yet achieved in projection lens performance. It combines all the advancements in the art so far developed. Longer focal lengths could be supplied if projection machines were provided with lens holders competent to receive them. Until such changes are made in projectors, however, it is impossible to employ in theatre projection lenses with a speed of *f*/2.0 in focal lengths longer than 5 inches. The lens is made in focal lengths from 2 to 5 inches in ¼-inch steps.

● The Petzval Type f/2

At the same time, a second series of lenses has been designed with a speed of *f*/2.0 of the Petzval type, shown in Fig. 2. In order to maintain good definition with the increased relative aperture it has been necessary to increase the length as compared to the old Cinephor, and this leads to a decreased back focus. At the same time it is necessary to maintain such a diameter for the back components as to make it impossible to adapt these lenses to projectors of designs prior to current manufacturing models.

This lens was designed to give high speed at the lowest possible price. It is offered, therefore, without the special features that characterize the Super Cinephor: namely, treatment of surfaces and sealing, features that can be added only at a substantial increase in price. The same condition that limits the focal length of the *f*/2.0 Super Cinephor to 5 inches applies also to this case, so that there is no point in making these lenses in focal lengths longer than 5 inches. They are offered in a series beginning with 3 inches and extending to 5 inches, in ¼-inch steps.

Discussion:

Q. How long do you think the sealed interior surfaces will require no attention?

Dr. Rayton: I can only hazard a guess, based on our experience of one year with such lenses in the theatre practice, in daily use. These lenses showed no signs of change of the internal surfaces within that length of time. I dare say that the answer to the question depends entirely upon the durability of the seal, and I suppose in the course of time that material may break down and permit the lens to begin to pump air. It seems to me that it is safe to hazard a guess that that will not happen in less than five years—maybe ten years.

Mr. Kellogg: What is the magnitude of absorption in the glass?

Dr. Rayton: In optical glass it is half a per cent per cm, and from that on up to 2 per cent in glasses still usable in optical instruments. In other kinds of glass—window glass and the like, it can, of course, reach very much higher figures.

Q. Mr. W. C. Miller tells me that in lenses treated for camera work an unexpected phenomenon was found. In photography there appears to be an advantage beyond the apparent improvement in transmission. Untreated lenses producing flare apparently put an overall fog upon the emulsion of the film, upon which the photographic image has to be superimposed, and apparently the film must be unduly exposed to superimpose the image upon the fog so produced. Is that explanation valid? I am interested to see whether or not in projection we have been having a similar situation on the screen.

Dr. Rayton: Both in projection and in photography, I think the answer is yes. With a projected image of good contrast, a better subjective reaction is obtained with a lower level of illumination than with a higher level of illumination, if the contrast is poor. I have seen examples of photography done with these lenses that seem to prove Mr. Miller's point. although it is not a factor that can be expressed quantitatively. Person-

(*Continued on page* 28)

Messrs. McGuire and Finn Honored by Toronto Local 173





PICTURED above is the unique form of medallion representing honorary life membership in Toronto Pojectionists' Local Union 173 which was presented to P. A. McGuire, advertising manager of International Projector Corp., and James J. Finn, editor of I. P. The medallions, marking the 30th anniversary of Local 173, were presented at the I. A. Convention in Louisville, Ky., by a committee consisting of W. A. Covert, I. A. vice-president and business representative of Local 173; C. Dentlebeck, president, and Arthur Milligan, secretary of the Local.

The presentations were made "in recognition of the services rendered for the advancement of the art of projection and for the welfare of projectionists". Said Mr. McGuire: "It is a great satisfaction to me to have this tangible evidence of appreciation for work done in behalf of raising projection standards and obtaining recognition of the importance of the projectionist's work. Those of us who are in or very close to the craft should never lose an opportunity to create goodwill for both the art and the craft.

"Receipt of this medallion is doubly appreciated by me because of the warm personal friendship that exists between the membership of Local 173 and myself." To which need be added by the writer of these lines only a fervent "Amen".—J. J. F.

Theatre Sound System Optical Data

By *R. J. KOWALSKI*

PHOTOPHONE SERVICE DIVISION RCA MANUFACTURING CO., INC.

ONE of the most vital links in the chain of elements that make up a sound-on-film reproducing system is the soundhead optical system. The quality of sound reproduction is largely dependent on the proper design and adjustment of this unit. The function of the optical system is to form the light from the exciter lamp into a beam of proper dimensions which is used to scan the sound track as the film passes through the soundhead.

The amount of light from the scanning beam which gets through the sound track varies in accordance with variations in the density or open area of the sound record on the track. These variations in light are converted by a phototube into electrical impulses which subsequently are amplified by the system amplifier and then converted to sound impulses by the loudspeaker system.

There are three fundamental types of optical systems used in sound on film reproduction. These are the cylindrical lens, the "motion picture," and the "stereopticon" systems. The first is so named because of the shape of the lenses it uses. The latter two types derive their names from the fact that their lens arrangements approximate that of their namesakes. Fig. 1 shows diagrammatically the arrangements of each of these three systems.

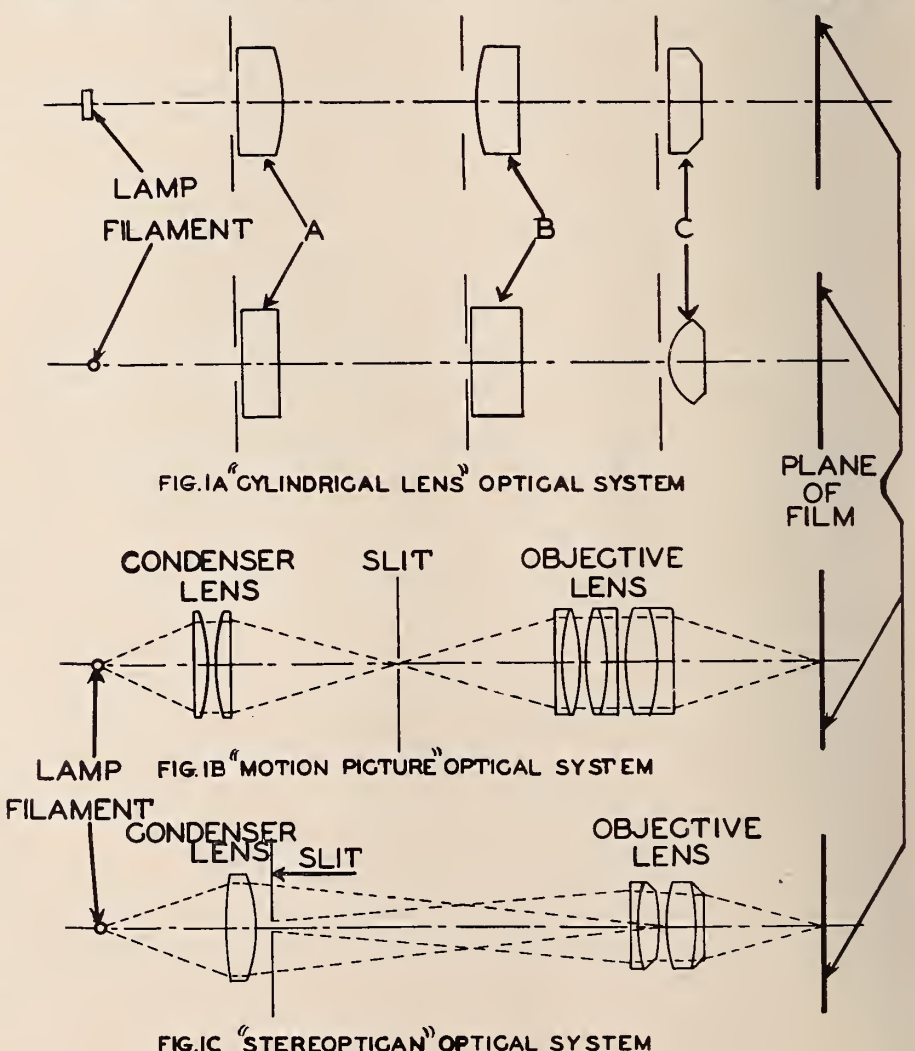
The cylindrical lens system, unlike the other two types, does not use a mechanical slit to determine the size and shape of the scanning beam it produces. Instead the image of the exciter lamp filament itself is focused directly on the film after being reduced to about one-tenth its original size. Therefore, the physical size of the exciter lamp filament determines the width of the scanning beam.

Referring to the top half of Fig. 1A, which represents the lens arrangement in the horizontal plane, condensing lens *A* forms an image of the horizontal dimension of the exciter lamp filament in objective lens *B*, which in turn focuses this image in the plane of the film. An aperture is placed in front of the condensing lens which defines the length of the scanning beam. In the lower half of the diagram, which represents the lens arrangement in the vertical plane, lenses *A* and *B* do not affect the light beam since they are flat in this plane. Lens *C* focuses an image of the vertical dimension of the exciter lamp filament directly on the plane of the film.

In the "motion picture" system, shown in Fig. 1B, the image of the exciter lamp filament is focused approximately in the plane of a mechanical slit. The image of the mechanical slit is then focused in the plane of the film by the objective lens. Examination will show that this optical setup is identical to that used in projecting motion pictures where the light source is the arc crater. The condenser lens is the condenser in the arc lamp, the mechanical slit is the picture aperture, the objective lens is the projection lens, and the plane of the film is the screen.

● The 'Stereopticon' System

The "stereopticon" system differs from the "motion picture" system chiefly in that the mechanical slit is placed immediately adjacent to the condenser lens as shown in Fig. 1C. The condenser lens focuses an image of the exciter lamp filament at the objective lens instead of at the mechanical slit. The mechanical slit which is adjacent to the condenser defines the limits of this image. The objective lens focuses the image of the mechanical slit at the plane of the film just as in the preceding system. Examination will show that this optical setup is identical to that used in a stereopticon for projecting slides



AREN'T THOSE COLOR SCENES *Beautiful* JOHN!



● I never saw anything more realistic in any theatre. In fact, all the pictures in this theatre are so much better than they used to be: Am I imagining things?

No, Mary, Mr. Robinson, the Manager of this theatre, is a friend of mine and he told me that they have recently installed a new type of projection light known as the "One Kilowatt" High Intensity arc. This new light is designed especially for the small theatres. It is a snow white light like daylight and there is half again as much light on the screen as they had formerly. That's why the pictures are so natural and easy to look at.

All I can say, John, is that it's wonderful and believe me I am going to tell my friends about it. Mr. Robinson is to be congratulated for his progressiveness.

CARBON ARC PROJECTION LAMPS

have a simple but highly efficient optical system.

The words "National" "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

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WITH GOOD REASON

FROM long experience, cameramen confidently rely on Eastman negative films to more than meet today's production requirements. Extra quality—reserve power—supports each film's special ability; and each is firmly established as the raw-film favorite, with good reason. Eastman Kodak Company, Rochester, N. Y.

J. E. BRULATOUR, INC., *Distributors*

Fort Lee Chicago Hollywood

PLUS-X
for general studio use

SUPER-XX
when little light is available

BACKGROUND-X
for backgrounds and general exterior work

EASTMAN NEGATIVE FILMS

where the slides are placed adjacent to the condenser lens.

One of the major problems encountered in designing an optical system for a soundhead is that of obtaining uniform illumination across the full length of the scanning beam. Extensive tests have shown that it is possible to get equivalent results with anyone of the aforementioned types of optical systems. The adjustments of the exciter lamp for uniform illumination, however, are the least critical for the cylindrical lens system, while more precise adjustments are necessary for the "motion picture" system.

[A complete analysis of the factors affecting uniformity of illumination in the three different systems is given in a report by Mr. F. E. Carlson of the General Electric Company in the July, 1939, issue of the *Journal* of the Society of Motion Picture Engineers.]

The advantage of the cylindrical lens system, from the standpoint of ease of adjustment, has made it very popular for 16 mm. sound work where the width of the scanning beam is not too critical. RCA Photophone uses the "stereopticon" on all soundheads because the adjustments in connection with this system are much less critical than for the "motion picture" system, while the final results are equally uniform.

● Photophone Optical System

Figure 2 shows a cross-sectional drawing of a typical Photophone curved slit optical system. The series of lens are mounted in a sealed brass barrel. The mechanical slit used in this unit is curved rather than flat to give more accurate focus of the image of the slit in the plan of the film and hence more uniform illumination across the resulting scanning beam. The dimension of the mechanical slit is another 0.005" x 0.420", or 0.00625" x 0.420". Since the optical reduction

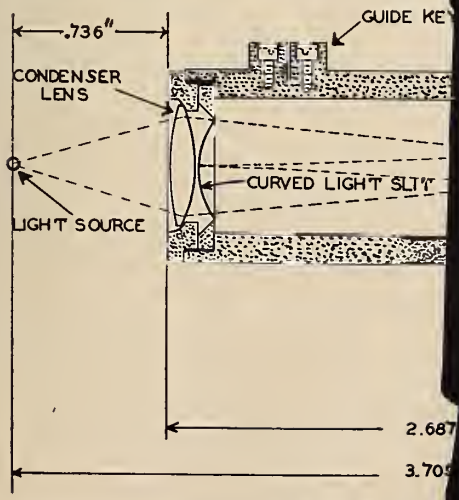


FIGURE 2. *Typical Ph*

Control Cabinet." The trouble was loss of sound on one machine, which the projectionist could restore at will by striking the control cabinet with his fist. Ordinary checks indicated everything was in order. But, the relatively simple circuits of the 713 Control Cabinet had 29 pressure contacts (switch, key, *etc.*), 16 screw connections, and 71 soldered joints—each a possible source for transient loss of sound.

There was only one thing to do: clean and check the tensions of all pressure contacts, check each screw connection, and resolder every joint that looked the least bit off-color under critical examination. Inspector Larson did not stop this treatment with the 713 Control Cabinet; he did the same to all the equipment that could be jarred by striking the cabinet.

● Hum Sources Difficult

Another tough trouble to correct on is hum. Hum may vary between the common 60-cycle variety, the high-pitched generator whine, and the irregular crackle of a marquee flasher. All projectionists know the importance of proper shielding and the grounding of conduit and shields. The matter of circuit grounds is a different thing.

In the early days, it was not uncommon to ground the speech circuit of a sound system at several different points, mostly as a matter of tradition and convenience. Since the development of systems with greatly increased gain and wider frequency range, and the added emphasis upon low noise level, it has been found important to connect together in a particular sequence the ground side of the circuits of individual units of a system and then tie the whole, at one point only, to a common water pipe ground.

Many of the old systems with several grounded points operate for years without giving trouble, and then, suddenly, some form of hum or pick-up will develop. Such a case was encountered by Altec man Ed Briggs out in Missouri. Loud hum appeared on the No. 1 machine but not on No. 2. By turning on and off different A.C. circuits, Briggs determined that the hum was being picked up in No. 1 pre-amplifier from the lamp on that machine. Operation of the sound system otherwise was normal.

Briggs found what he termed a "circuitous ground" within the system wiring, together with a corroded joint. Apparently, when the arc lamp was turned on, a difference of A.C. potential developed between two of the grounded points in the system in such a way that the spurious A.C. hum potential was applied to the sensitive low level circuits of the pre-amplifier. Correction was effected by removing the several grounds in the system and replacing them by one single common ground connection.

Sound Track Standards Revised

A REPORT OF THE RESEARCH COUNCIL, ACADEMY OF MOTION PICTURE ARTS & SCIENCES

SINCE early in 1936, the industry has discussed various proposed standards for sound track dimension and placement, but changes in equipment and practice, both in the studios and in the theatres, have been such that the establishment of definite formal standards has been impracticable until recently.

Late in 1938, proposed sound track standards were submitted by the Society of Motion Picture Engineers to the Sectional Committee on Motion Pictures of the American Standards Association. These proposed standards were subsequently re-transmitted for consideration to all organizations participating in the work of the Sectional Committee. The Academy of M. P. Arts & Sciences then appointed a Committee on Sound Track Standards.

As a first step, the Committee conducted a comprehensive investigation on current film shrinkage, weave, tolerances in recording, printing and reproducing, and gathered together all of the available data on the length of scanning slits actually in operation in theatre reproducers.

At approximately this same time, a great number of reports were transmitted to the Research Council from various authorities in charge of theatre field operations, detailing troubles encountered in properly scanning then-current release print sound tracks. In general, these reports indicated that there were many of the older types of theatre reproducing equipment still in use in the field equipped with slits narrower than the accepted standard 84-mil width.

● Committee Recommendations

After a thorough investigation of these reports and of the prevailing scanning conditions in the field, upon the suggestion of this Committee the Council recommended that all servicing organizations in charge of theatre sound reproducing equipment, wherever possible, replace all sub-standard scanning slits with standard 84-mil slits. In addition, it was recommended that for the present the effective width of all variable area sound track (100% modulation) be held in the studios to 70 mils with the thought that when field conditions warrant this width may later be expanded to the full 76 mils available.

Acceptance of these recommendations immediately removed the source of a great percentage of scanning troubles, and within the next six months reports of this type of trouble practically ceased to come in from the field.

While the immediate reduction in variable area track width served to remove the most important source of field reproducing trouble, the Committee simultaneously commenced the preparation of recommendations to formally standardize sound track dimension and placement based upon the following considerations:

(1) To set forth specifications for the sound track *print* only, inasmuch as the negative is under the control of those making the recordings, who also have the responsibility for making a negative which will result in a print of these specifications at the time of the start of the release run. It should be emphasized that these Specifications are not *printing* industry practices, but are *release* print industry practices. Each laboratory should secure standard sound tracks on release prints in the manner most practicable for that laboratory.

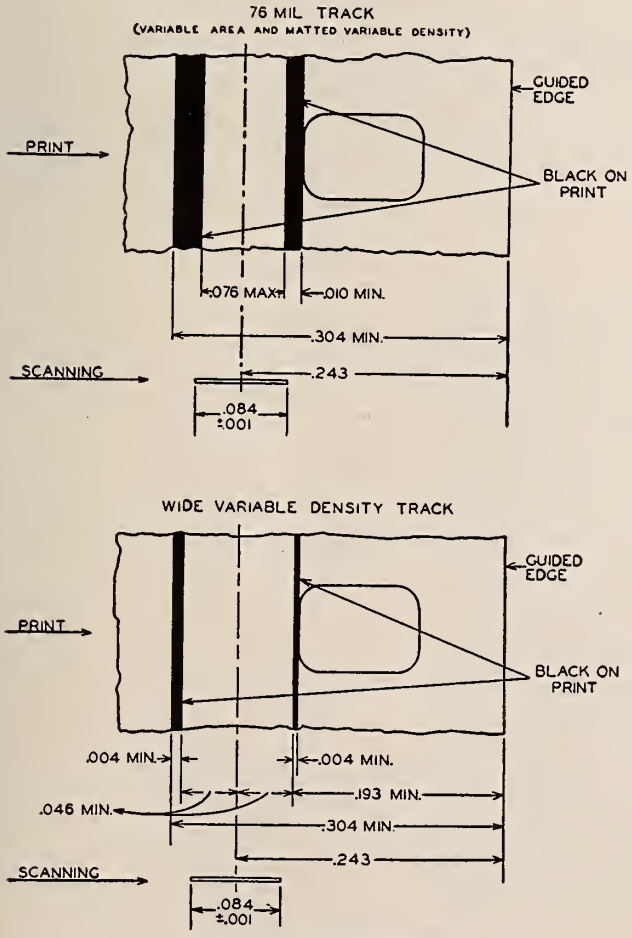
(2) To specify only the most important dimensions; that is, those dimensions which should and can be accurately controlled, as follows:

● Effective Track Width

(*a*) In the case of the wide variable density track: to provide an opaque area between the sprocket holes and the track edge to minimize sprocket hole development effects, and retain a reasonable minimum track width which will insure optimum use of the full width of the scanning slit.

(*b*) In the case of the 76-mil

(*Continued on page* 28)



ALL DIMENSIONS SPECIFIED IN INCHES.
ALL DIMENSIONS TO APPLY ON THE PRINT AT START OF RELEASE RUN.
DIMENSIONS HAVING NO TOLERANCE SPECIFICATION TO BE MAINTAINED TO MINIMUM PRACTICABLE TOLERANCES. A DEVIATION GREATER THAN 0.002" IS UNDESIRABLE IN ANY CASE.

Here are the specifications of the Release Print Sound Track as proposed by the Research Council of the Academy of M. P. Arts & Sciences on May 17, 1940.

Cleveland Film Show on 50 x 70-ft. Screen at 500 Feet

Utilizes 2000 Watts and 80 Loudspeakers

WHEN it comes to projection on *le grande* scale the palm must go to these Cleveland Local 160 fellers. Just imagine a setup involving a throw of approximately 500 feet onto a screen 50 x 70 feet, plus the calculation necessary to insure good sound reproduction in a mammoth arena such as the Cleveland Municipal Stadium, and one begins to have a faint idea of the sort of job these boys tackled and licked hands down. The accompanying illustrations tell their own story most effectively.

The date of this event was July 4, the occasion the "Festival of Freedom" sponsored by the Cleveland Independence Day Association, the picture "The Bill of Rights," a Warner release. Appreciative bows are due Martin L. Sperber, chief, and Jerome Friedman, projectionist members of Cleveland Local 160; Lou Walters, National Theatre Supply branch manager, and E. B. Brady and A. L. Bosworth, Altec engineers.

The equipment utilized to turn the trick included Simplex projectors and Simplex 4-Star sound equipment, a multiple Hall & Connelly h.-i. lamp, and a Hertner 200-400 ampere, 95-volt generator. National Carbon's super-high 13.6 mm. carbons, pulling 200 amperes at 73 volts provided the light, utilizing Superlite 8-inch lenses. *Only* 80 loudspeakers were used, and this had to be adroitly set in horseshoe shape around the field in front of the stands in order to overcome the difficulty imposed by a time lag experienced when projecting sound a distance of 1,200 feet. The lower loop on the projector head was dispensed with, for obvious reasons.

The sound amplification was really something: 2,000 watts of power were developed, the equivalent of the total power that would be required by 100 theatres of 1,000 seats capacity.



Part of the throng of 80,000 who jammed every nook of the huge Cleveland Municipal Stadium. 50,000 were turned away.



View of the projection booth, at 2nd base, looking over the 500-ft. throw toward the 50 x 70 ft. screen.



Equipment setup and those responsible for its setup and operation: (l. to r.) M. Sperber, L.U. 160, chief; Lou Walters, N.T.S. Co.; J. Friedman, operative, and E. D. Brady, of Altec.

The show attracted a capacity audience of 80,000 people, and the police estimated that more than 50,000 were turned away. Projectionists Sperber and Friedman experienced some anxious moments toward the end of the show when it appeared doubtful that the 22-inch carbon, burning at the rate of a inch a minute, would last for the duration of the 21-minute film. It did.

As far as the writer knows, this show established an all-time high on the scores of largest single motion picture audience, longest film projection distance, and largest screen ever utilized for a moving picture that looked like something. The job reflects great credit on everybody who participated in the setup and operation of the equipment, and Cleveland Local 160 has reason for particular pride in the contribution of its members to this occasion.—J. J. F.

Metal Film Steadily Progresses

By *Dr. ROBERT W. CARTER*
TAYLOR-SLOANE CORPORATION

The appearance in these columns of the accompanying article is due to the graciousness of our friend and colleague, Mr. George Blaisdell, editor of "American Cinematographer," wherein it first appeared. While this article gives evidence of the wide gains chalked up by metal film during recent years, the addendum thereto should have the careful consideration of every projectionist before any definite opinions on the topic are formulated.

THE advent of metal film for practical use took place in November, 1938. Executives, exhibitors and experts in the motion picture field have witnessed demonstrations of pictures and sound from metal film. They were unanimous in their opinion that metal film has an immediate and widespread use in the entire projection field.

It should be stated at the outset that metal film will in no wise jeopardize the present status of the professional projectionist. It is true that the fire hazard has been completely eliminated. It is also an established fact that metal film will not break or tear in its passage through the projection machine. We submit that with the removal of these hazards the projectionist will be better able to concentrate his attention on his main objective, the superior projection of motion pictures.

The first machine used for the projection of metal film was an adaptation of a standard model with gate, optical system and soundhead converted especially for this purpose. The machine was so constructed that it could serve a double purpose. It could be used for the projection of both standard cellulose film and metal film.

The task of changing from one to the other was a matter of a few seconds. For metal, the lamp is swung to the front, a special gate is put into position and the metal film is threaded through the other soundhead which is specially constructed for metal film.

This first machine gave us the basis for a fair comparison between metal and celluloid film, since both could be projected from the same machine under the same conditions. The tests proved that metal film was equal to celluloid film in pictorial quality and slightly superior to celluloid film in sound value.

● Basic Physical Facts

For the benefit of those who desire the fundamental physical facts about metal film we state the following: The film is constructed of a special alloy and is usually .003 inch in thickness; the image is on a highly reflective surface, and projection is by reflection from this surface.

A reel of 1000 feet, 35 mm., weighs 6½ pounds. The film may be spliced with a special cement in the usual manner. The film is threaded through the projection machine in the standard manner, with the exception of one sprocket which leads to the reflecting soundhead. The film is not affected by the heat from the lamp. It will never shrink or stretch, and with ordinary care will last indefinitely.

The optical system does not require condensers or any device to prevent the light ray from striking directly upon the film. The full power of the light is impinged directly upon the metal film as it passes through the gate aperture. The light reflects directly from the polished film surface through the lens to the screen[1].

In extensive tests, metal film showed a reflection factor 12 per cent higher than cellulose film. Anxiety was expressed about the possible noise that metal film might make in its passage through the machine. The demonstration proved that metal film is just as silent as the standard film. The reason for this is that the film does not shrink or stretch, and passes through the sprockets with mechanical precision.

The important questions from the various laboratories center around the character of the emulsion and the processes of printing and finishing. A positive print is made on a metal film with the same machine and in the same manner as a positive print on cellulose film. The negative is brought into contact with the sensitized metal and exposed to the source of light. The printing time on metal film for any given emulsion is less than for ordinary film.

Developing is more rapid than usual, and the time for fixing and washing is about half that ordinarily required. The drying economy is the most remarkable of all. The film may be passed through a drying cabinet at temperatures as high as 450 degrees F. At this temperature the film will dry in 2½ minutes. Emulsions on metal may have the same photographic values as those used on cellulose.

Where metal film is required as a negative, the exposure time in the camera and the general photographic technique is the same as usual. The developing, fixing, washing and drying of a metal film negative may be done in one-third the usual time.

The outstanding superiority of a metal film negative is the unusual absence of grain, coupled with positive permanence and practical indestructibility.

● Any Type Emulsion O. K.

The metal negative must be printed by optical printing. When prints on both sides of the metal are required, a standard Debrie printer may be used for this purpose. If this type of printer is not available, both sides of the film may be printed in a standard machine, and the whole then developed. Care should be exercised to keep the emulsion surfaces from scratching or abrading while in a wet condition.

Any type of photographic emulsion may be coated upon our metal film. The essential physical requirement is the treatment of the emulsion together with the treatment of the metal base. This includes the necessary reduction of the interfacial tension in the emulsion and the rendering of the metal surface compatible with such an emulsion.

● Considerations of Life

The advantages of metal film from the laboratory angle are many and important. These include positive uniformity in the co-efficients of expansion and contraction, the elimination of stretching and shrinking at all times and under all conditions, and standardization in all operations because of the fixed factors inherent in metal film.

We believe that metal film is ideal

1. Data regarding the optical system for metal film, in addition to comparative reflection factors, will appear in an early issue of I. P., probably the next.—ED.

for color work. It is well known that the passage of light through the cellulose base and three-color film surfaces not only diffuse and refracts the light but seriously reduces its velocity. We have found that a color print on metal with its high reflecting surface gives a more luminous image on the screen than is obtainable with the ordinary color film now in use. Coating, printing, developing and projecting from metal film are based on fixed physical factors, and the making of color film can be likewise standardized.

Our statement in a recent issue of a widely read weekly magazine that cellulose film would not last for 20 years was challenged by one of the distinguished scientists in the photographic field. In our answer, we produced such overwhelming evidence that we believe this phase of the controversy to be now closed.

To the many librarians, government officials and technicians, we convey our regrets that we were forced to insist on the fact that cellulose films were not to be depended upon for permanent records. We submit that all unbiased scientific investigation has established the fact that cellulose film should not be used where an endurance of over ten years is essential. It is gratifying to know that valuable cellulose negatives now in existence may be printed on metal film with the positive assurance that they will endure indefinitely.

Those engaged in aeronautical photography have been concerned with the adaptation of metal film for their purpose. We propose to produce an 8-inch roll of metal film in 500-foot lengths that will not exceed 16 pounds in weight. With a positive emulsion, this may be developed in the air and calculations carried out with the utmost accuracy based on the fact that the metal expands and contracts equally over the entire surface.

We have taken positive prints on a roll of metal with a positive solution, exposed the same, and secured the finished print in less than three minutes. Photographic development on a metal film is confined exclusively to the emulsion. In amidol or metol hydroquinone, development takes place in less than two seconds washing; fixing may be done in 60 seconds; and final washing and drying over any heated unit in a further 60 seconds. We find the results of the print are permanent and almost grainless.

In case of fire, the image is not destroyed until the heat reaches the melting point of the metal.

In conclusion, it is necessary to deal briefly with the great number of inquiries from persons using 6 mm. film. This is of special interest to us, as we believe the intimate records of childhood and the valued records of science and business deserve a permanent photographic medium. We are developing as rapidly as possible machines for projecting 16 mm. metal film, since we are convinced that the high costs in this field will be considerably reduced with the use of our film.

This feature together with the facts of positive non-inflammability and permanence offers professionals and amateurs in the 16 mm. field something to look forward to with keen anticipation.

It is particularly gratifying that metal film makes a major contribution to the field of sound recording of voice, music and all phases of sound reproduction. The sound track on our highly reflective metal ribbon has proven to be ideal for the reproduction of radio programs. Both sides of the film may be used and as many as ten tracks may be printed on each side, thus giving 200 minutes of sound recording on 1,000 feet of film that weighs 6½ pounds and takes up a space of 8 by 1⅜ inches.

One of the major applications for metal film is in the field of permanent record. The opportunity now presents itself to record imperishably the word and deed of our living great, distinguished men and women in the fields of science, literature, medicine, politics and the other ranges of human endeavor.

What would we not give if we could see and hear the immortals who have made their impress upon the history of American civilization. The utmost which our forefathers could do was to record their words and actions by means of books.

Current Technical Opinion on Metal Film

APROPOS the accompanying paper anent metal film by Dr. R. W. Carter is the circumstance that several years ago INTERNATIONAL PROJECTIONIST had occasion to submit to ranking laboratory technicians in the motion picture industry samples of metal film for examination and comparison with nitrocellulose film. Their findings at that time (1934) were as follows:

(1) The loss of light during projection would be almost prohibitive and, to make a rough guess, under any given conditions, the screen intensity would be only about 1/50 that existing when projecting by transmitted light with the usual motion picture film.

(2) If the metal film becomes buckled, it remains so more or less permanently.

(3) The edges of the perforations have no resiliency, so that they are much more readily distorted by the sprocket teeth than with nitrocellulose film.

● Problem of Splicing

(4) It is doubtful whether the degree of adhesion of the emulsion to the film would be satisfactory.

(5) It would appear to be extremely difficult to splice the film satisfactorily. The manufacturers have not suggested any method of splicing.

(6) With highly alkaline developers, it is probable that the aluminum would be attacked, and also, prolonged fixation in a fairly acid fixing bath containing silver salts would cause the deposition of silver which would tend to impair the high reflecting power of the aluminum surface.

Coincident with preparations for publication of Dr. Carter's paper in this issue, I. P. requested these same laboratory technicians to review their findings of several years ago on the basis of the generally admitted progress of metal film in the intervening period. Their answers may be summarized thus:

● Current Qualified Opinion

The findings embraced by the foregoing Items 1 to 6 are essentially correct, although Items 4 and 6 may not apply to the latest type of metal film and should be ignored on the assumption that, apparently, the metal strip is not coated with a gelatin film.

With regard to Item 5, it is stated with great emphasis by the proponents of metal film that a satisfactory "special cement" has been developed which will give "satisfactory" results; but it would be extremely interesting to a large majority of technical workers in the industry to have tests made to determine the strength of such splices.

This, then, is the pro and the con of the discussion relating to the comparative merits of metal and of nitrocellulose film. In the absence of any positive proof tending to prove the assertions made on both sides of the fence —without which, of course, no judgment can or should be passed thereon—it occurs to I. P. that it might prove invaluable to the motion picture industry to arrange a symposium wherein all aspects of the matter could be considered thoroughly and in an impartial manner. The S. M. P. E. would seem to be the logical body to arrange such a meeting, particularly since the next Convention of the Society will be held in Hollywood wherein are located technical experts on just such matters as are at issue in this case.—J. J. F.

RCA SOUND SERVICE TOOLS

BY RCA PHOTOPHONE ENGINEERING STAFF

(The first instalment of this article appeared in June)

II.

ONE of the recently developed special instruments is the audio curve tracer. This is a portable device which traces an amplifier response curve automatically on the screen of a cathode-ray tube. By using a tube with a long-persistence screen, such as the *RCA*-910, the image is retained long enough for it to be studied, photographed, or a second curve superimposed on it for comparison. With this instrument it is possible to run an accurate frequency response curve in approximately thirty seconds.

Figure 5 is a schematic drawing showing the operation of the instrument. The output of a beat-frequency oscillator is fed both into the "horizontal control" potentiometer *R*-1 and into the input of the amplifier under test. The voltage developed across *R*-1 is fed through a resistor-capacitor network to ground. The characteristics of this network are such that with a constant voltage *E*-1 impressed across the network, the voltage developed across *R*-6 varies directly as the logarithm of the frequency impressed. This is shown in the small curve above.

The voltage *E*-6 is impressed across a diode section of the *RCA-6H6* tube and is rectified. The rectified voltage causes current to flow through resistor *R*-7, producing a negative bias voltage at the grid of the *RCA*-57 d-c amplifier tube. The greater the voltage *E*-6 becomes the more negative the bias on the *RCA*-57 becomes.

The plate supply voltage to the d.c. amplifier is 450 volts. The actual voltage at the plate of this tube is equal to this voltage minus the voltage drop in the plate resistor *R*-8 caused by the flow of plate current. Hence, as the plate current is reduced the drop across the plate resistor is reduced and the voltage at the plate of the tube becomes higher. The plate voltage is applied directly to one of the horizontal deflection plates of the cathode-ray tube. The opposite deflection plate is at some potential above ground which is determined by the setting of the centering control potentiometer *R*-3.

When the beat-frequency oscillator is set at a low frequency the voltage *E*6 is low. Hence the current through *R*-7 is small and therefore the value of negative bias is small. This causes a large plate current to flow in the *RCA*-57 and reduces the voltage at the plate of the tube because of the large drop in the plate resistor. This reduces the voltage applied to the right deflection plate below that at which the left is set causing the beam to be deflected to the left (that is, toward the more positive plate).

When the frequency of the oscillator is raised, the voltage *E*6 goes up, more current passes through *R*-7 producing a higher bias voltage, the plate current of the *RCA*-57 is reduced, and the drop across *R*-8 is very small, leaving the voltage at the plate of the tube, and consequently at the right deflection plate, higher than the voltage of the left deflection plate. Under this condition the negative beam of electrons is deflected toward the right plate which is now the more positive.

Thus, by merely tuning the beat-frequency oscillator through its frequency range the electron beam is moved across the screen horizontally with a displacement which is always proportional to the logarithm of the frequency impressed.

The output of the amplifier is fed through the "vertical control" potentiometer *R*-2 to ground. A portion of the output voltage is rectified by the second diode in the *RCA-6H6*, amplified by a d.c. amplifier identical to the one already described and applied to the vertical deflection plates. By analysis similar to that for the horizontal deflection circuits, it is evident that an increase in amplifier output will cause an upward deflection of the beam.

Thus, for any given frequency at which the oscillator may be set, the frequency determines the horizontal position of the spot, and the output level of the amplifier determines the vertical position of the spot. Therefore, if the oscillator is swept through its frequency range, the spot will trace a response curve of the amplifier under test. Fig. 6 shows the overall schematic diagram of the complete audio curve tracer.

In addition to the beat-frequency oscillator as a source of signal, a continuously variable frequency test-film is available which can be run through the soundhead to produce an overall response curve of the complete sound system.

The "film-oscillator" switch at the input of the horizontal amplifier connects either of two high-frequency boosters in the circuit. In the "oscillator" position a slight rise is added to make up for the reduction in output of the oscillator at the high frequencies. A more pronounced rise is provided

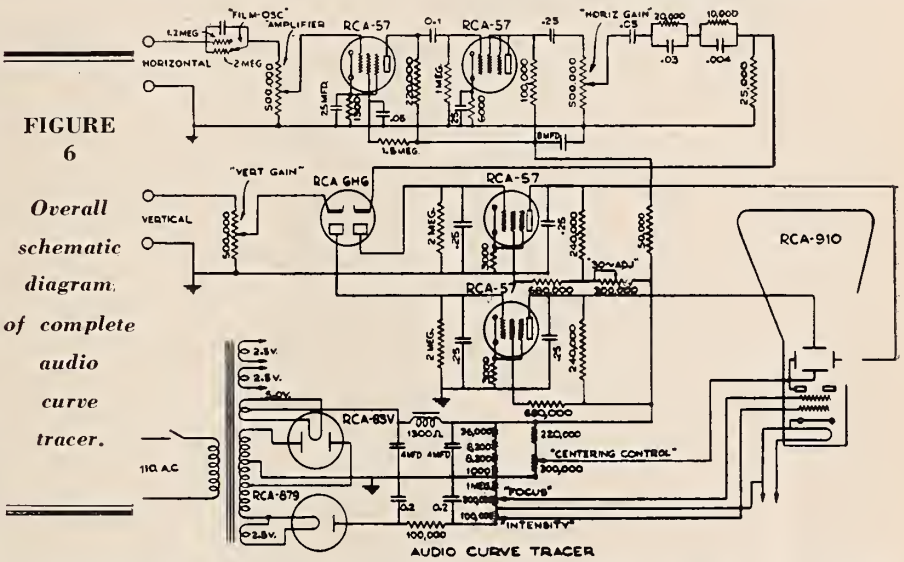


FIGURE 6

Overall schematic diagram of complete audio curve tracer.

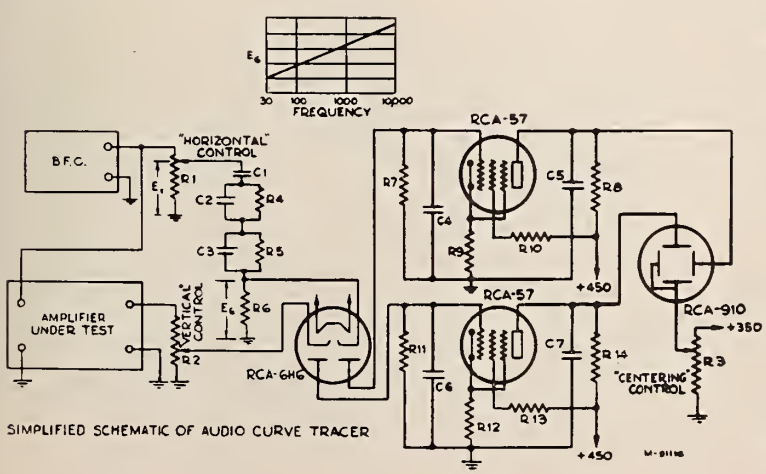


FIGURE 5

Audio curve tracer, simplified circuit.



FIGURE 7. *Audio curve tracer.*

in the "film" position to compensate for the optical losses in the sound-head at the high-frequency end.

An additional control, the "30-cycle adjustment," has been added so that the voltage drop at the plate of the horizontal d.c. amplifier can be lowered independently of the voltage at the vertical d.c. amplifier, making it possible to move the spot horizontally without affecting its vertical position.

Figure 7 is a picture of the audio curve tracer. This is housed in a carrying case similar to that of the three-inch oscillograph. The front panel contains the "focus" and "intensity" controls, the "horizontal" and "vertical" inputs, the "horizontal gain" and the "vertical gain" controls, the "horizontal amplifier gain" control and the "film-oscillator" compensation switch. The "centering control" and the "30-cycle adjustment" control are screwdriver adjustment control on the side of the case.

● RCA Flutter Indicator

Since there are still thousands of older equipments in use which are subject to flutter trouble, RCA has available a Flutter Indicator which will aid the service engineer in making adjustments to reduce flutter to a minimum (Fig. 8). Flutter is actually frequency modulation of the reproduced tone caused by irregular motion of the film past the scanning beam; hence any one of several frequency-discriminating circuits may be used to detect these irregularities.

In the past few years, several different types of flutter-measuring devices have been built. Most of these employ circuits which are quite similar to those used in automatic frequency-control circuits used in broadcast receivers, or frequency-deviation meters used in transmitting stations. While these instruments are extremely accurate, they require the use of one or more vacuum-tubes together with associated power supply circuits. This reduces the portability and hence makes the units unsuitable for field work.

The discriminating network used in this instrument is merely the familiar Wheatstone bridge used as an impedance bridge with reactive impedances in two of the legs. The constants have been chosen so that when a 3000-cycle signal is fed into the network it can be balanced, and a meter placed across the network will read zero. If the frequency of the input signal varies above and below 3000 cycles, the network will become unbalanced by an amount that is proportional to the variation and the meter will show a corresponding deflection.

A specially recorded 3000-cycle film with low flutter content is run through the sound-head under test and the flutter indicator is connected to the output of the system amplifier. Any variations in output can be measured directly on the meter.

The input transformer has several impedance taps, so this instrument can properly terminate the system amplifier without the use of additional load resistors. An input control provides vernier adjustment of the input level to the measuring network. The "read-calibrate" switch allows the meter to be used for calibrating the input to the measuring network or for reading the flutter voltage developed across the output of the network. Two ranges of sensitivity are made available through the use of the range selector switch. These ranges are 0.5 per cent full scale, or 2 per cent full scale. Resistance and capacity balance controls allow the resonance frequency of the measuring network to be shifted slightly to compensate for slight variations in speed between various sound-heads. The meter is a 500-ohm Rectox type volume indicator with a scale that is hand-calibrated directly in per cent flutter.

By using this instrument as a guide in adjusting the tension in the soundgates of older types of sound-heads, it has been possible to reduce the flutter from as much as 2 per cent to as little as 0.3 per cent.

Another new tool, which is available through the Academy of M.P. Arts and Sciences, to give the field engineer a better check on the operation of the theatre sound system is the scanning illumination test-track.

● Scanning Test Track

This film is made up of seventeen consecutive sound-tracks, each of which is displaced a different distance from the guided edge of the film. The individual tracks are unilateral tracks approximately 7 mils in width and modulated approximately 100 per cent at 1000 cycles. The distance between the centerlines of the consecutive track is 6 mils, allowing a slight overlap from one track to the other. The centerline of the first track occurs at approximately 197 mils from the edge of the film, and the centerline of the last track 292 mils from the edge of the film, and the total track width is approximately 110 mils. Each track announces itself by number at the start, and the length of steady-state condition is 10 feet, with 2 feet allowed for moving from one track to the next and 1 foot allowed for the announcement. This makes a total of 13 feet for each of seventeen sections.

A single running of the film provides the following information:

(1) The length of the slit, (2) The uniformity of illumination across the slit, and (3) The approximate amount of weave in the machine.

As an example of the information obtained from running this film, it was run through an older type equipment and the following facts were established: The effective length of the slit was approximately 73 mils; the illumination across the slit was uniform within ±1 db; and the weave in the machine was approximately 6 mils.

(To be continued)

STILL ANOTHER JUKE-BOX

"Talk-a-Vision" machines are currently in production in the East, and they, together with the 16 mm. product they project in the course of their operation, will be ready for delivery to initial customer-outlets by late October or early in November.



FIGURE 8

The RCA flutter indicator.

Addendum:

Air-Cooled, High-Brightness Mercury Vapor Lamps

Arriving too late to be included in our June issue, as promised, is the appended discussion incident to the paper of the above title, which appeared in our March issue this year. The addendum goes far toward clarifying numerous points made in this paper and should serve to keep projectionists abreast of the very latest developments relative to this ultra-modern light source. I. P. will undertake to provide answers to any other aspects of this question which may not have been clarified.

L. J. DAVIES said that the authors had shown that the electric discharge lamp is now entering the field of the projector illuminant. He thought the difficulty of the lamp shape had been got over in a very clever way, for the lamp man had been asked to make lamps to suit projectors, linear lamps for certain applications, and squat or compact forms of lamps for others.

The linear lamp could be regarded as competing with the filament lamp, for hitherto the only way of obtaining a linear light source was to suspend an incandescent filament within a tubular bulb, and the compact source type of mercury vapour lamp could be regarded as competing with the carbon arc. He thought this point should be emphasized.

In the carbon arc one had a light source with consumable elements, the carbons, and a somewhat complicated mechanism, namely, the carbon feed. The arc, however, was a source of good color output and one which had virtually no thermal delay times, and, as its use for modern theatres had shown, was highly reliable.

In the case of the compact or air-cooled mercury vapour projector lamp, one had the sealed-off, easily replaceable, pre-focused light and great simplicity. It had certain color difficulties and certain thermal delays which might cause difficulties in some applications. It must be remembered, however, that the present carbon arc has behind it many years of development and practical application; while the projector mercury vapour lamp is only at the start of its career.

● Early Applications Seen

He felt that it would not be very long before this lamp had many important applications, brought into being either by modifications to the lamp or by adaptations of methods of application.

Results obtained by his colleagues agreed very closely with the data presented in the various curves in the paper. He was a little puzzled at the reference to cadmium and the implication of the possibility of using a mercury-cadmium vapor lamp to give correct color rendering. The introduction of cadmium, of course, had improved color rendition, but he had found that there was a rather rapid deterioration when cadmium was used.

Regarding the statement that "the view has been expressed" that the color distortion is not sufficient to matter, he would remind the authors that the only expression of view that matters is that of the box-office, and he doubted whether he could agree that the color distortion could be dismissed so easily.

J. W. Ryde remarked that, until recently, high brightness had not been a consideration in the design of electric discharge lamps. Indeed, it was not desirable in a lamp for general service lighting. The requirements of a light source for projection purposes, however, necessitated profound modifications in lamp design.

● Arc Brightness Range

He thought that the authors had shown great restraint in their description of the troubles which have had to be overcome. If the lamp were wrongly designed, the arc might writhe about, or the quartz envelope might devitrify, soften, or blacken rapidly—and these were only a few of the things that could happen.

It was interesting to note the enormous range of brightness now exhibited by discharge lamps. Negative glow lamps normally had a brightness of less than one-tenth of a candle per sq. cm.[1], sodium lamps had a value of 10, while, at the other end of the scale, experimental lamps of the type described by the authors could be made to give brightnesses well over 100,000 candles per sq. cm., or over a million times that of the normal glow lamps.

He was glad the authors had used the word "starting" instead of "striking" when referring to the initiation of the discharge. It was true that the carbon arc was started by touching the electrodes together and the term "striking" had probably grown up from that, but he felt that it was not a term which should be used in connection with electric discharge lamps in which the electrodes were not even touched together.

R. HOLMES asked if there were likely to be any difficulties due to the stroboscopic effect and the interruption of the light on the screen by the shutter at certain frequencies, or whether the lamp were more or less a continuous source of light.

S. R. EADE referred to figures relating to theatre projection in the published version of the paper, and asked if the authors could state the total lumens reaching the screen. While he did not for a moment query the authors' statement that the brightness was dependent on the source brightness, the diameter of the objective, and the throw, the practical theatre man was normally given a throw to which he must accommodate himself. He was limited by the commercially available lens aperture and was asked to produce a screen brightness of, say, 11 ft.-c. as a minimum on the screen which was, perhaps, 22 ft. or 24 ft. wide. In addition, he must achieve a certain measure of uniformity of illumination across the screen width.

The figure which was normally

[1] One cm. equals 10 mm.

Valuable Current Literature Free to Projectionists

CURRENT literature offered free to projectionists by manufacturers constitutes an important addition to the fund of information that should be had by every serious projectionist. RCA offers a valuable booklet covering all aspects of sound reproduction in the theatre, replete with diagrams and halftones. Very good, indeed and a "must" for projectionists. Ask RCA, through Camden.

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John Hertner has been working far into the night(s) again, and the fruits of his labor are apparent in a new folder which gives the low-down on the very latest Transverter. Power source addicts can obtain same by addressing Mr. H. at 12692 Elmwood Ave., Cleveland.

• • •

Harry Strong will accommodate all and sundry who want to be on top of his new Utility h.-i. arc which has been cutting quite a swath through the field. Ask him at 2501 Legrange St., Toledo.

• • •

Clint Phare, flushed by the sensational success of his Signo-Marker at the recent I. A. Convention, will supply the whys and the wherefores on this useful item to anyone inquiring of him at 218 E. 214th St., Euclid, Ohio.

conformed to was a ratio of 1.5:1 from the centre to the edge. The variation in intensity across the arc width of the high-pressure discharge source, particularly if the image of that arc was formed in the film gate, made the achievement of the necessary screen intensity distribution fairly difficult. The only clue in the paper to the actual figure of screen illumination was, perhaps, the reference to the fact that it was about one-quarter of that of the carbon arc. If one assumed that the carbon arc referred to was of *average* and not *maximum* efficiency, it might give 4,000 lumens on the screen with the shutter running, for the compact discharge source.

J. M. WALDRAM asked whether the authors would agree with the principle, which appeared to emerge from their paper, that if the brightness of a light source were increased at the expense of its area, the increased brightness could be fully utilized only in "complete flash" projectors, and only to the extent that the apparatus was capable of remaining completely flashed with the smaller source. It seemed to him likely that the introduction of small and very bright light sources would lead to greater precision in the design of optical and illuminating engineering apparatus.

● Spectral Characteristics

J. S. DOW remarked that in the case of the colored lantern slides which had been shown, it was naturally evident that the reds were in some degree deficient, and asked whether it was possible for fluoresence to be applied to these lamps to secure an improvement.

He also inquired whether, in view of the fact that the spectrum of the source described consisted of individual lines partially coalescing, there was any special necessity to use achromatic lenses, so as to prevent spoilage of the appearance of fine detail on the screen.

It did seem, as the authors remarked, that there was a definite accentuation of perspective and more complete revelation of detail in the case of films projected with the mercury lamp. The process which was taking place in getting a more and more continuous spectrum, whilst beneficial for color effect, seemed rather to have the opposite influence so far as sharp definition was concerned.

It might even be better from this standpoint to insert filters such as would cut out these parts of the spectrum which tended to be fuzzy, leaving the other regions, which contributed to greater clearness of image.

J. A. PROWSE said that in focusing a projector to ensure maximum evenness of screen illumination, one usually attempted to focus the image of the light source onto the objective. He understood the authors to say that the image of the light source should be focused onto the actual slide or film, and wondered if this interpretation were correct.

In connection with the apparently improved definition of lantern slides when projected by high-pressure mercury vapour lamps, was that attributable in any way to the fact that the light from the lamp, when condensed, formed a truer cone in that there was not so much spill as with the larger source of the filament lamp.

C. J. MILNER asked by what process the color slides shown had been made. It was mentioned that in certain processes the colored photographs were processed to obtain direct color reproduction with the carbon arc light, and in other processes the aim was color reproduction with the tungsten light. Due to the quite different spectral distribution of the light from these two sources, the color defects with the mercury lamp would be much more serious in the case of pictures intended for projection with tungsten lamps than those intended for projection with the carbon arc.

He referred to the question put by Mr. Davies as to whether the curve showing the percentage of red radiation from mercury discharge with different loadings, had been obtained, in the case of the compact source of light, with or without the light from the electrodes being included.

In that connection he said that work with which he had been concerned on this subject indicated that the red light from the electrode was a negligible part—or less than 5 or 10 per cent—of the total red light from these lamps. This could be easily confirmed by examining the lamp or projected image of it through a Wratten No. 25 filter. This showed that the arc was very much brighter in red light than the electrodes.

S. ANDERSON said he was very curious about the extension of the various spectral bands with the increase in brightness and pressure of the mercury vapour lamp. He was quite prepared to believe that this happened, because he had seen it happen; but why did it happen? If this effect were a function of the brightness, how was it that, as we had seen with the lamp demonstrated, the spectral bands had so increased in width as to become very nearly continuous radiation; yet in the case of the sun where the brightness was much higher, narrow bands still showed up and could be identified with the various elements.

THE PRESIDENT remarked that under the existing regulations theatre projection rooms were limited to 250 volts. He inquired if any attempt had been made so that high voltage mercury vapour lamps, taking more than 250 volts, could be used.

THE authors, replying to the discussion, agreed with Mr. Davies that the new mercury vapour lamps described were probably destined to play a very important part in projection problems. People would be pleased to get away from the complication of the arc lamp in spite of the excellence of its performance when it was well controlled.

With regard to their pronouncement on color, they said that the opinion on this point given in the paper was expressed by people in the motion picture industry. Unfortunately, it was not stated in the preprints that those who expressed the opinion were thinking more of the educational and less formal type of semi-private showing of films than of the ordinary commercial picture house.

Regarding the effect of cadmium on the compact source lamp, the authors agreed that in some circumstances the presence of cadmium caused devitrification of the quartz bulb and thereby shortened the useful life of the lamp. At the same time they were not convinced that it was always so, and there might still be a useful field in which cadmium could be used.

It was not, however, the intention of the authors to suggest that cadmium was necessarily the best method of improving the color. It was mentioned to illustrate the fact that there were methods by which the color of the mercury vapour discharge could be improved.

As to stroboscopic and allied effects mentioned by Mr. Holmes and Mr. Iles, one would expect to run the lamp on D.C. in such applications as film projection and

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sound recording, although it might be necessary to re-design the electrodes for continuous D. C. operation. The authors had projected 16 mm. motion picture film at 16 and 24 frames per second, with the lamp running on the ordinary 50-cycle supply. When there was no film in the machine the flicker was noticeable; but when projecting film it was difficult to detect the flicker and the average person would probably never be conscious of it. For sound-film recording, the compact source type of lamp should be of particular value on account of its output of short wave-length radiation.

Screen Brightness Measurements

Regarding the number of lumens reaching the screen. Tests made on a variety of lenses had shown that the screen illumination and the flux reaching the screen could be calculated with considerable accuracy from the size of the flashed area and its brightness. It is true that large aperture lenses cannot always be flashed by the illuminating system to their full area, but the calculations apply if the area considered is that actually flashed.

A further set of measurements has been made since the figures given in the preprints were obtained. These later results apply to a 12-cm. focus objective lens,

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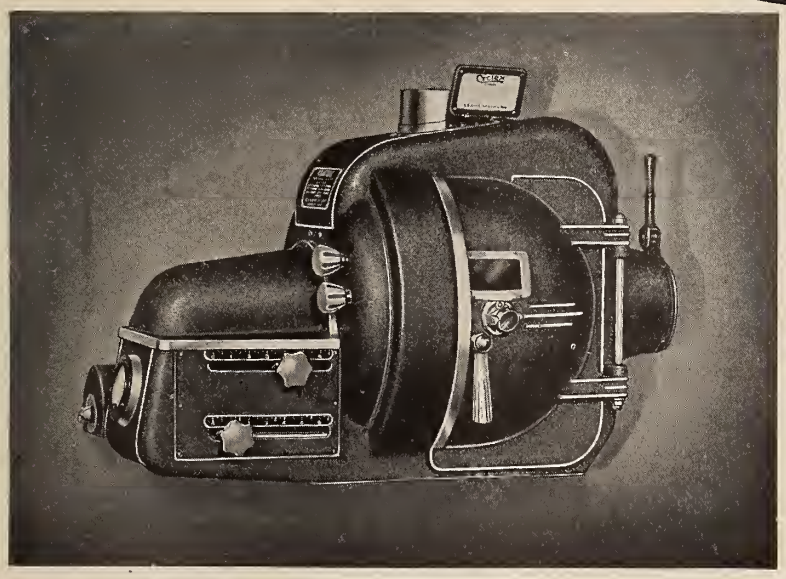
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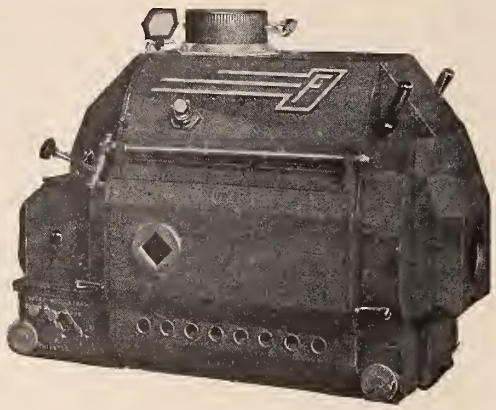
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which is fairly typical of the focal lengths used in practice. The lens was flashed with a circular image of an ellipsoidal mirror behind the lamp, to a diameter of 5.7 cm. The total light reaching the screen was 3,350 lumens, allowing for 50 per cent absorption by the shutter.

With lenses having the same diameter of 5.7 cm. but a longer focal length, a full flash was always obtained, so that the screen illumination remained substantially constant, although the lumens on the screen were reduced in proportion to the size of the picture. The same was true for smaller diameter lenses over a range of focal lengths above and below 12 cm.

Using a lens of 5.7 cm. aperture and a shorter focal length than 12 cm., the full aperture of the lens could no longer be flashed, because of the limited angular subtense of the mirror illuminating system. In this case the lumens on the screen were substantially the same as with the 12 cm. focus lens, as all the flux passing through the film aperture was accepted by the lens.

The screen illumination, however, was reduced in proportion to the flashed area.

Apropos the diversity of illumination over the screen, this was found to be no greater with the compact source lamp than with a 55-amp. high-intensity arc. The value was about 1.6 to 1.

Temperature Characteristics

The authors said that there was very much less heat from mercury lamps than from tungsten lamps when the light was passed through a number of glass components. There was about one-quarter of the temperature rise of an object in the beam. Measurements had been made on a human face as the object, and it was found that 2,000 ft.c. of tungsten illumination through a prismatic lens of the kind he had shown was unbearable, but 6,000 ft.c. from a mercury lamp was quite bearable. However, they did not know whether that could be interpreted in terms of specimens used in micro-projection.

In the authors' view, Mr. Waldram was correct in his interpretation of the conclusions of the paper, namely, that high brightness was of major importance only when the optical system was giving a full flash.

Regarding Mr. Dow's point on the possibility of using fluoresence in projection by having fluorescent material on the lens, the authors felt that unless one could get fluorescent material which would accept light and then re-transmit it in the same direction in which it was passing through the lens, the effect would not be produced.

It seemed to them possible that reducing the blueness of the light and giving it a more continuous spectrum might affect the sharpness of the image, although there did not seem to be any explanation for the apparent sharpness of the mercury image on the ground of visual acuity.

They were inclined to think it was due to the fact that the small source size produced less stray light, and, therefore, less diffusion in the image of the slide, and also that the objective lens was, in effect, stopped down. If that were the case, then, provided the source was kept small, adding more red to it and making it less monochromatic would not have any effect.

Projection lenses were normally corrected for chromatic aberration, and the authors expressed doubt if any reduction in the correction would be practicable when the new discharge lamps were used, as there was considerable continuous radiation.

In reply to Mr. Prowse, the authors said

that in the lantern slide projector the image of the light source was formed by the condenser somewhere about the position of the objective; but in the case of the film projector, because the film was so small, the light was focused down onto the film. The beam diverged after the film and entered the objective lens, which was usually of a relatively large diameter.

In some of the small film projectors the optical system tended more towards that of the lantern slide projector. The reason Mr. Prowse had suggested for the sharper definition when a small source was used in a slide projector seemed likely to be correct. A small carbon arc showed a somewhat similar effect which was not attributable to line radiation.

The authors were grateful to Dr. Milner, who had mentioned the projection microscope and the question of diffraction. The colored slides were produced by the Dufay process, and were intended for viewing in daylight to get the correct color impression.

'Broadening' of Spectrum Lines

The relation given for the high pressure mercury discharge seemed to hold with surprising accuracy for a very wide range of current and voltage. The reason for this might be that at these very high pressures and current densities, the mechanism providing ionisation was largely thermal, *i.e.*, the degree of ionisation depended simply on the temperature of the gas, and if that were so it would be expected that the loading or wattage dissipation per unit area of the discharge column would be the chief factor which would control the brightness.

Mr. Anderson raises questions concerning the broadening of the spectrum lines as the pressure and loading was increased in the high-pressure mercury vapour discharge. At high pressures the interactions between atoms caused the electron energy levels to become disturbed and "broadened." The electron transitions, therefore, instead of giving rise to a discreet set of lines, produce broadened lines and the continuous radiation which is usually obtained when there is strong interaction between the atoms.

Of course, a source need not be bright in order to produce a continuous spectrum. In a mercury vapour discharge, however, the necessary conditions for producing high brightness also give rise to wide spectrum bands.

In the case of the sun, conditions are quite different. The continuous spectrum is the result of a complicated process of radiation and absorption, and is akin to the radiation from a hot solid. The lines in this spectrum appear dark against the continuous background, and are caused by absorption in the cooler vapour in the outer regions of the sun's atmosphere where the pressure is low.

Theatre Voltage Regulations

Commenting on the President's remarks, the authors said they did not know if any steps had been taken with a view to getting an amendment of regulations governing voltage in projection rooms in cinemas. It would be possible to operate lamps of the compact source type on 250 volts, D. C. or a slightly lower voltage, and they would just come within the regulations; but the water-cooled lamp which had been designed for application to projection in theatres required a higher voltage, and if representations with regard to the regulations had not already been made, the authors thought it would not be long before somebody did so.



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Signo-Marker Dissents

I noticed the item by F. M. Armstrong (RCA) in your "At Your Service" section for June, and I feel that he has not helped projection in general by his suggestion that Griswold patchers be converted into handy cue markers. I have seen at least six of these made-over patchers, and noted the results they produce. This observation is one of the reasons for the existence of Signo-Marker today.

If done properly, it is not a bad idea; but Mr. Armstrong surely must know that while most projectionists are mechanically capable of following his suggestion, very few have the necessary facilities for doing the job as accurately as is necessary to obtain good results. Furthermore, if the job were taken to a machine shop, the cost would be considerably more than the price of Signo-Marker.

CLINT PHARE
Clint Phare Products Co., Cleveland.

SOUND TRACK STANDARDS

(*Continued from page* 17)

track: to limit the effective track width *on the film itself* by the establishment of opaque areas rather than by the length of the reproducer scanning slit. On the variable area track these opaque areas will be of such dimensions as to insure full use of the track width; and on the matted variable density track will be of such dimensions as to maintain proportionality between the various squeeze track matte widths and the resulting output.

(3) To specify all dimensions from the guided edge of the film.

(4) To specify tolerances only where tolerances apply to dimensions established in manufacture and are therefore not easily subject to change; and to specify that other dimensions be carefully controlled so that deviation from any dimension having no specified tolerances will be held to a minimum.

(5) To specify a sound track so placed on the negative that the track center line *on the release print* will be at a proper distance from the guided edge of the film at the time the print starts its release run. The Committee arrived at this recommendation because of the fact that every release print laboratory has a fair knowledge of the shrinkage at the start of the release run of their prints. (If at some time in the future, negative sound track standards are set up, such standards would be considered as entirely separate from these specifications for release print sound track.)

● Specifications Acceptable

(6) To draw up these specifications so as not to contradict certain nominal practices which have existed throughout the industry for the past 8 or 9 years.

It is believed that the specifications set forth in the accompanying drawing fulfill all of the aforementioned considerations.

This report and the accompanying drawing was transmitted to the studio sound departments, sound equipment manufacturers and release print laboratories, for comment and criticism in advance of its submission to the Research Council. The report contains a number of modifications suggested by representatives of the aforementioned groups, and is approved by them as presented herewith.

NEW LENSES FOR PROJECTING MOTION PICTURES

(*Continued from page* 11)

ally, I am leaving it out of consideration in any quantitative statements in connection with projection. It is a factor of real significance, but I do not know how it can be measured quantitatively.

Average Loss Per Surface

MR. FARNHAM: I believe that the average surface loss is 4 to 5 per cent. To what value does this treatment bring it?

DR. RAYTON: Actual surface loss may

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run to higher than 5 per cent. It depends upon the index of reflection of the glass; 5.5 per cent is sometimes given. Some lenses average 5.5 per cent loss per surface. The reduction of reflected light by evaporating films on the surface can reach, I should say, a figure of three-quarters of the originally reflected factor. Perhaps it is not too much to assume that it can be reduced to 1 per cent per surface. That is perhaps a little optimistic, but for convenience and calculation it is fair enough.

There is a tendency in some of the literature to be a bit over-optimistic with respect to the gain in transmission. Please bear in mind that it would be utterly impossible to gain something under the circumstances that is not taken away in the first place. If we have a lens system whose maximum loss, due to reflection, is 30 per cent, it is absurd to say that the transmission of the lens can be increased 50 per cent by any surface treatment, because we should have to reduce the light lost by reflection by more than 100 per cent.

MR. WELMAN: The earlier *f*/2.3 Super Cinephor was not a Petzval lens, was it?

DR. RAYTON: No.

MR. WELMAN: You made your comparsion of 30 per cent by comparing the new lens with the Petzval *f*/2.4. What would be the comparison of this lens with the earlier Super Cinephor of 2.3?

DR. RAYTON: The product of the three factors that I mentioned as contributing to increased illumination at the maximum brought us to a value of 61 per cent, comparing the new Super Cinephor against the old *f*/2.4 Cinephor. Compared with the old Super Cinephor you would add another 10 or 12 per cent.

16-mm. Field Applications

MR. MAURER: A great deal of what Dr. Rayton has told us is of decided interest in the 16-mm field. The comment has often been made to me by competent observers that the quality of the lenses in general use for 16-mm projections leaves a great deal to be desired. It is generally, and I think somewhat erroneously, assumed that 16-mm equipment must be held down to low cost in *all* its components. As a result, sometimes we find what I feel to have been unnecessary and undesirable sacrifices of quality in overall results.

With that in mind, I should like to ask Dr. Rayton, not with a view to accuracy, but just as to the general order of magnitude, what are the comparative costs of the anastigmat Super Cinephor construction and the Petzval type of construction commonly used for 16-mm projection lenses?

DR. RAYTON: Between perhaps 5 and 10.

MR. KELLOGG: If you look back toward the projector in a theatre, you see an impressive amount of light coming from the lens surface, and also from the light-beam, due to scattering by the dust in the air, or smoke. I wonder whether the light scattered in this manner is much of a factor in making haze on the screen. Also, how much of a light scattered by the lens surface may be due to dust and scratches? These specks look intensely brilliant when you look at the lens from close by.

DR. RAYTON: There is no doubt that dust on lens surfaces is responsible for considerable diffusely distributed light. It is not so bad that every last speck of dust has to be removed, or that one should worry about every little scratch that appears on a lens surface. Nevertheless many lenses are used in a condition that is practically criminal, from the standpoint of the quality of the image.

MR. ROBERTS: What is the relative efficacy of the two treatments used in the Super Cinephor; or, what is the difference between the coating used for the inside surfaces, which I understand is a relatively perishable coating, and the external treatment which can be handled a little bit more roughly?

DR. RAYTON: We can only answer the question for the particular kind of glass employed in this construction. Whereas the applied coating can produce an effect equivalent to reducing reflection to one-quarter of its original value, the other method used on the external surfaces reduces it to one-half its original value. The difference between the two methods, if applied to the external surfaces, will affect the transmission of the lens perhaps 5 per cent.

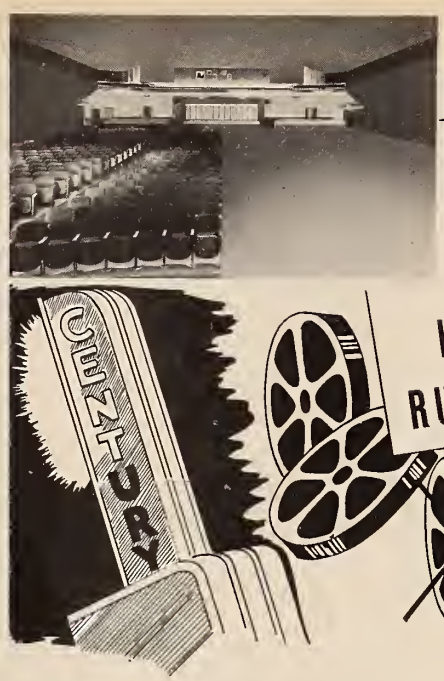
MR. ROBERTS: Can the outside treatment be applied to eye-glasses?

DR. RAYTON: It can not be employed on the glass ordinarily used on eye-glasses.

MR. HOVER: I suspect there will be many projectionists who will worry about

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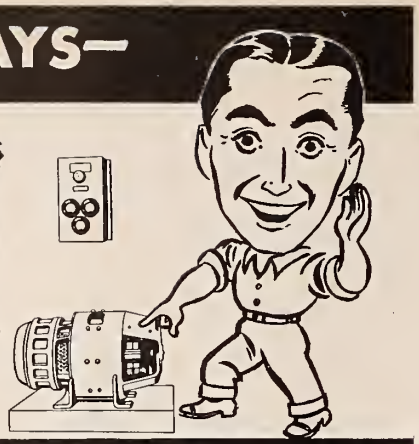
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the sealing of the lens. We might remember that some of us have the better grade of optical systems in the sound mechanisms and those lenses are sealed. I have one pair, of excellent make, that has worked a little over five years, without any difficulties whatever, and I believe that the optical system in the sound mechanism frequently (the rear of it, at least) operates at a rather high temperature.

MR. KURLANDER: What is the absolute transmission constant of the Super Cinephor lens having eight air-glass surfaces, treated and untreated?

DR. RAYTON: Approximately 65 per cent for the untreated lens, and from 80 to 85 per cent for the treated lens.

For Current Projectors Only

MR. FRANK: The *f*/2 Super Cinpehor lens can be used only in the current models of projectors, such as the Simplex, the Super Simplex, and the *E*-7. By modifying the lens holders of the older models, which the manufacturers are prepared to do at a reasonable cost, these lenses can be used with them. I am a little uncertain, however, concerning the statement you made as to whether the same thing is true in the case of the *f*/2 Cinephor lens, or whether I am to interpret your statement as meaning that under no conditions can the *f*/2 Cinephor be used with the older model of the Simplex projector.

It should be pointed out also that the old Series 2 Cinephor lenses are available only with treated surfaces, and the less expensive type, as heretofore, without treated surfaces, is no longer manufactured.

MR. SCHEICK: Any of our lenses can be supported without any unusual adaptors in the Super Simplex and the *E*-7 Simplex. But in the old standard Simplex mechanism, it will be necessary to use the special adaptor you have built called the 62-*C*, which will support any of the lenses whatsoever in the mechanism.

MR. KURLANDER: What is the method of sealing employed?

DR. RAYTON: It is the same type of sealing that has been used successfully in the sound reproducer—the use of a gasket and a material that is oil-proof and maintains its elasticity indefinitely.

MR. PALMER: One point discussed when the coated lenses were demonstrated recently was whether there is a color difference in the light projected through coated and uncoated lenses.

DR. RAYTON: Undoubtedly there is a difference, just as there is a color difference in the light reflected from ordinary glass surfaces. The question is probably inspired largely by the fact that the appearance of these treated surfaces is decidedly colored. However, when you stop to think that the amount of light reflected from them only amounts to, say, 1 per cent of the incident light, any selectivity in that 1 per cent ceases to have much significance. If there is selectivity in the 1 per cent, there is the same selectivity, or the complement of it, in the transmitted light.

Undoubtedly, if sufficiently precise measurements had been made spectrophotometrically, there is a change in the color of the transmitted light. That can be controlled to a considerable extent in the applied process. That is one of the factors that has to be watched in the practical application of the treatment, and careful attention is given to it. I do not think that, controlled in that way, the results can create any color disturbance of any significance.

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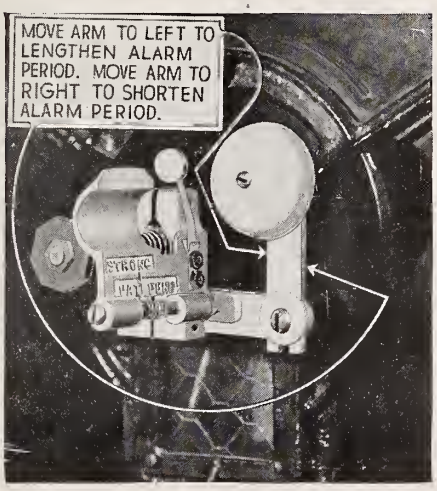
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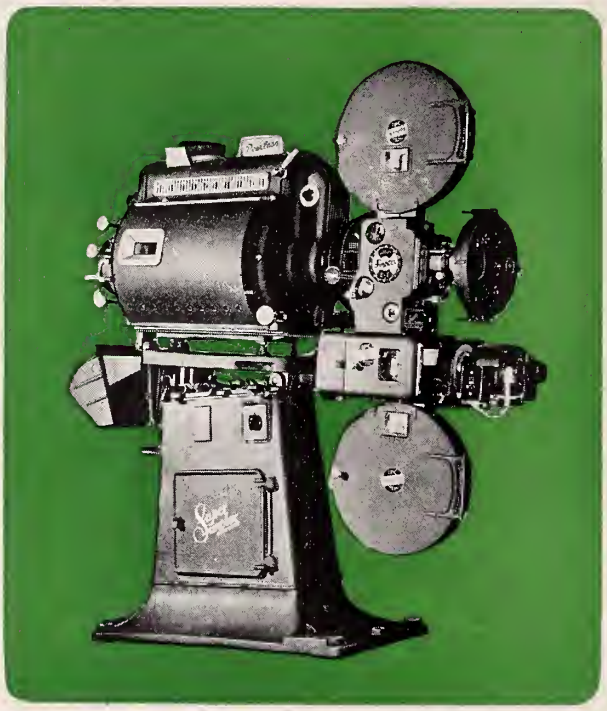
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OCT 30 1941

International PROJECTIONIST

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Edited by James J. Finn

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Monthly Chat

AS THE summer wanes, it becomes apparent that the differences of opinion relative to technical standards and other matters which prevented cooperative action by the F. C. C. and the sponsors of nation-wide television systems seem likely to be resolved in the near future in favor of the latter group. Cessation of broadcasting during the summer months was merely the lull before the storm, so to speak, because all the leading television groups, notably N.B.C. and C.B.S., utilized this period to revamp and hypo their existing setups.

Evidence of this fact is at hand in the demonstration recently by Columbia of Dr. Peter Goldmark's color television process. True, this stunt was accomplished *via* wire from one room to another; but Dr. Goldmark showed enough to indicate that he can repeat the performance through the ether anytime he elects to do so.

Still unanswered is the question as to the degree of cooperation that will exist between television broadcasting and the motion picture business. Already it is apparent that the motion picture studios will ultimately get the major portion of television production work. But where does this leave the theatres? This corner doesn't know the answer to this one; although it will hazard a restatement of its guess of two years ago that with a television set functioning in the home, there isn't the slightest need for anybody to stretch a shoelace or a necktie in order to attend any community showing of television images at the neighborhood movie.

The television people ridicule the idea that their efforts will harm the small movie theatres (the backbone of the industry), but until such time as proof of their contention is forthcoming, our guess stacks up well alongside their optimistic press releases.

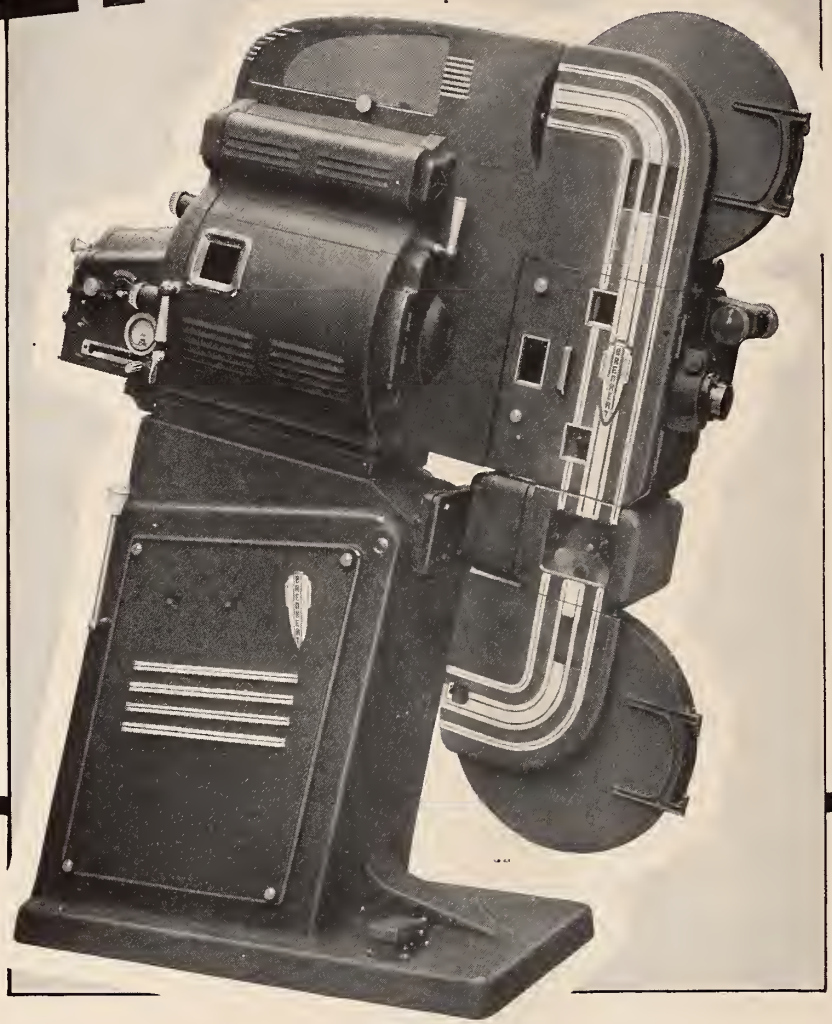
To date organized labor has made no move to execute labor contracts with the television studios, the stated reason for this inactivity being that the art still is in the "experimental stage" and thus provides no basis for contract negotiations. However, the I. A. is known to be watching television developments closely, and action on the labor front may be expected within the next several months.

I. P. will maintain a lively interest in the progress of television, which will be reflected in an increasing amount of space devoted to the art during the coming year.

• • •

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INTERNATIONAL PROJECTIONIST

VOLUME XV AUGUST 1940 NUMBER 8

Sound Screens: Structure and Function

By *G. F. HOLLY*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

PROJECTIONISTS are familiar with, or are actually operating, many recently developed units which are necessary essentials in the modern and efficient projection room. Since the advent of sound pictures, many improvements have been made in practically all of the major units that go into the makeup of a complete picture projection and sound reproduction system.

Among recent developments in the field of motion picture projection are several new types of arc lamps that produce a better light at less cost for electrical energy and carbons than their predecessors. New types of projectors now coming into general use have as a salient feature dual shutters which transmit more light to the sound screen. Also now being made available are projection lenses which have their individual lens surfaces treated through new scientific processes that greatly reduce the harmful reflections from the several lens surfaces and thereby cause more light to be passed by the lens. And in the sound reproduction field we have seen the sound system with its rotary stabilizer soundhead, high-power amplifiers, and two-way cellular horn loudspeakers accepted as the modern standard.

In all cases, however, the final result which a projectionist is able to achieve by the skilled operation of all this fine equipment is largely dependent upon the type, quality and condition of the sound screen. It is unfortunate that this most important and comparatively low cost item is seldom given the consideration it deserves. Everyone concerned generally seems to assume that because all the other equipment is functioning at peak efficiency the resultant picture and sound quality must be tops. That the sound screen may be offsetting much of their careful work is often overlooked.

Let us approach the problem from another viewpoint. While it is very important that the apparatus project light with the desired intensity and color balance *onto* the sound screen, the way in which these qualities are *reflected* by the sound screen is equally important. Similarly, one must consider how well the high quality sound *emanating* from the stage loudspeaker, is *transmitted through the sound screen*. Since the sound screen is the only link that is really common to both sound and picture projection, it can be a bottleneck that is seriously detrimental to most effective presentation.

● Deterioration Factors

It is well known that all types of sound screens now in general use undergo a steady deterioration from the day they are made. Unfortunately, entirely too many theatres do not consider this important fact and passively suffer the consequences. Although many types of screen bases with several kinds of reflecting surfaces are in general use, the basic make-up of the latter, which often is almost as perishable as a freshly picked banana, is much the same. The average sound screen of today uses as a base a woven cloth fabric which has been bleached and flameproofed. Typical processing may be as follows:

To secure opaqueness, two coats of aluminum are usually applied and followed by several coats of flameproofing dope. Then several coats of white pigment may be applied and the surface then roughed up by pinpointing to obtain light diffusion and to make subsequent coatings adhere better. One coat of white pigment then may be applied to the back, and about five more coats of zinc white and titanium on the front may complete the finished surface.

The completed screen must now be perforated. An accurate and extremely sharp die punch set must be utilized to secure correct diameter perforations with clean cut margins and thus assure the correct initial sound transmission qualities and a minimum of clogging from the accumulations of dust particles.

With a new sound screen of this type, some of the chemicals in the multiple coats of surfacing continue a slow process of evaporation and disintegration. Confirmation of this is

obtained by the ever-present odor emanating from the sound screen surface. In many territories certain gases in the air tend to speed up disintegration or evaporation of the chemicals and thus contribute to discoloration.

One of the most commonly observed effects is yellowing, but others which may not be as readily apparent also appear. The rough pigment surface collects dust which may tend to cause detrimental chemical reactions as well as darkening of the surface, commonly referred to as "greying". Dust also collects in the perforations, thereby reducing their diameter and seriously affecting the sound transmission characteristics.

● Continuing Light Loss

Technical data gathered by one reliable investigating body indicates that the light-reflecting properties of sound screens deteriorate at an average of approximately 4% per month. At this rate, at the end of one year, the average sound screen is only about one-half as efficient as a light reflector as when it was first made. Likewise, the sound transmission characteristics also deteriorate unless the perforations are kept clean.

At this screen age, either or both of two somewhat inefficient and sometimes costly remedies are commonly applied. In some instances, the projectionist increases the arc current, and while this may restore the reflected light to its original value, generally it is costly in the long run and, furthermore, it may contribute to uncomfortable viewing because the color and wave-length balance are not the kind of light quality that contributes to good seeing by the human eye.

Also, by this time the sound quality undoubtedly has suffered, and the sound engineer sometimes resorts to complimentary recompensation of the sound system amplifiers to accentuate the electrical output of the frequencies that are being attenuated unduly by the dust-filled perforations, thus blasting the sound through the screen by brute force. While this may help to make the sound more intelligible, the poorer sound transmission qualities of the screen cause a ragged response which detracts from the smoothness and natural characteristics essential to comfortable hearing.

In other instances, we find that resurfacing of the sound screen is resorted to when its light-reflecting properties become impaired. If this is skillfully done by one of the few experts specializing in this kind of work, an apparently good resurfacing may be had. However, it is generally agreed that a first-class job involves a multiplicity of coatings and that, regardless of how skillfully applied, the additional coats of resurfacing material make the sound screen thicker and reduces the diameter of the perforations.

In view of the fact that the thickness of the sound screen and the diameter of the perforations (for a given number of perforations per unit area) are the factors governing sound screen transmission characteristics, even a single resurfacing leaves it appreciably worse from a sound-transmission standpoint than when it was new. Likewise, the reflection characteristics, although they may appear to be as good as when the screen was new, never quite approach the original.

Nevertheless, many theatres resurface a screen approximately once a year for several years or more and replace it with a new one only when the perforations have become almost completely clogged. This particular method of coping with this difficult condition appears to be logical from a purely economic point of view only so long as all factors pertaining to this problem are not given their proper importance.

Regardless of what is done to the average sound screen, once it has deteriorated it is apt to be a relatively poor compromise from the standpoint of true efficiency. The projectionist may still be pouring good light through the projection port and good sound may be emanating from the stage loudspeakers, but the good work on both points may be nullified by a sound screen that has ceased to function within tolerable efficiency limits.

● Suitable Test Apparatus

Part of the lack of appreciation of the important qualities of a really good sound screen has been due to a lack of test apparatus capable of making comparatively rapid and accurate checks directly in the theatres where the sound screens are installed. While a few instruments have been available with which to measure incident light to the screen, it was not until very recently that a practical portable instrument that would reliably measure the reflection characteristics of sound screen surfaces was developed. To be truly valuable it must react to color values in the same manner as the human eye. Properly coordinated use of such instruments of recognized reliability may aid materially in determining the true efficiency of the light transmission characteristics of sound screens.

The sound transmission properties of sound screens depend upon a number of important details that seem to vary considerably with various types and make. As an example, one of these details is the varying weight or thickness. Another is the size and number of perforations per square inch. We find some sound screens with forty holes per square inch .050″ in diameter, some with twenty-four holes per square in .060″ in diameter, *etc.* Frequently one sees sound screens that from the standpoint of appearance would be expected to have adequate perforation but are too thick and consequently possess too high an acoustic impedance to permit good sound transmission qualities.

The S. M. P. E. standard provides that screen attentuation at 6,000 cycles shall not be greater than 25%, and at 10,000 cycles not greater than 37% relative to the response at 1,000 cycles. It should not be overlooked that this standard pertains to the maximum loss permissible and merely identifies a *tolerable* sound screen, which may not be an ideal one. From this it is apparent that there is considerable margin for improvement above the standard.

In view of the present characteristics of most types of sound screens in use, it may be well to remember that the best results from $10,000 worth of sound and projection equipment are obtained from the $100 sound screen by replacing it regularly at least once a year.

Sound Screen Brevities

All types of sound screens undergo a steady deterioration from the day they are made. . . In many territories certain gases in the air tend to speed up disintegration or evaporation of the chemicals and thus contribute to discoloration. . . Light-reflecting properties of sound screens deteriorate at an average of 4% per month. . . . Even a single resurfacing leaves a sound screen appreciably worse from a sound-transmission standpoint than when it was new. Likewise, the reflection characteristics never approach the original.

COMPLETING THE PICTURE

DRAMATIC lighting and unusual camera angles are only partly responsible for the startling beauty of modern screen productions. It takes Eastman negative films to do full justice to the cameraman's wizardry — to really complete the picture. Eastman Kodak Company, Rochester, N. Y.

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Technical Data Anent Metal Film

By *Dr. ROBERT W. CARTER*

TAYLOR-SLOANE CORPORATION

This is the secoud and concluding article in the series which details the progress of metal film during the past few years. This installment discusses laboratory procedure, emulsion characteristics, splicing and editing, projection optics, and 16 mm. applications of this new motion picture medium. Acknowledgment for the privilege of reproducing these articles is made to George Blaisdell, editor of "American Cinematographer".

IN last article we confined ourselves largely to the development of metal film up to the year 1937. The article brought in such widespread and important inquiries that we have been able to form a definite opinion regarding the keen interest in metal film and its projection.

The questions range from highly technical points regarding the reproduction of sound from metal film to practical points about speed of exposure, development and fixing of the image on metal.

Tests in the laboratory of International News Service with positive emulsion gave printing times ranging from 1/10 second to ½ second in standard photographic printing eqquipment. Technical experts at I.N.S. were astonished at the speed of developing and fixing. By actual timing the entire printing process took exactly four minutes. We refer, of course, to a contact print in a standard printing frame.

The four minutes was divided into one minute for loading the frame, ½ second for exposure, 6 seconds in the developing bath, and the balance of the time was taken up in fixing, washing and drying with electrical drying unit. The developers used were standard metrol and hydro-quinone. In secondary tests we used amidol, and in fixing alcoholic solutions of hypo and alum.

● Fine-Grain Metal Prints

These printing tests took place in series over a period of three weeks. Critical examination of the metal strip indicated no chemical reaction has taken place to affect the metal or the printed image. It seemed a difficult matter to fog the emulsion even with a 60-watt Ruby lamp.

All the operations in the darkroom were carried out under the same light that the laboratory uses for making bromide paper prints. The phenomenon that impressed the technicians in the photographic laboratory was the absense of grain in the emulsion on metal. The print finished in less than four minutes showed much less grain than the standard print on paper developed in fine grain developers, the latter printing taking more than 30 minutes.

It becomes obvious that for metal the mind has to become oriented to appreciate this new medium in photography. We have developed negative and positive emulsions that have a high gamma infinity, that are free from fog, even under the lighting conditions described, and have as high velocity content as cellulose emulsions. The advantage of such emulsions for motion picture negative will more than offset any difficulty that may be experienced in printing.

Many of our correspondents were worried about editing negatives on metal. We have worked out a simple method for splicing that is not more troublesome than the method used for cementing cellulose film. When the negative is made and edited it will be permanent, fadeless and indestructible. The original metal negative will be preserved in the usual manner. Duplicates are made with standard optical printing by reflected light.

● Reflection Tests

To offset another misconception we print herewith the actual reflection tests (Table A). This test established the fact that the metal ribbon has a higher reflection factor and is more effective for optical printing than is printing by transmitted light through cellulose film. We believe that this should save the industry thousands of dollars on insurance rates and storage costs and fire hazard.

We would like the many readers who are interested in microfilm, manuscripts, books, *etc.*, to know that we will be able to put images on both sides of our metal film. This means that the reproduction of books such as the Encyclopaedia Britannica with its 25,000 pages, 8½ by 11½ inches, weighing 126 pounds and occupying a cubic area of 4036 cubic inches can be microfilmed on metal to weigh 6 ounces and occupy a space of 10 cubic inches.

To the many who inquired about the permanent reproduction of programs at radio stations we are pleased to report that this may be done very economically on narrow strips of metal film giving accurate tonal reproduction in the higher cycles. This record, of course, will be permanent, fadeless and economical. We have already constructed a simple reading machine for metal film.

● Metal Film for 16 mm.

We must apologize to the many readers interested in 16 mm. projection, inasmuch as we neglected to mention this important field. We already have emulsions developed for microfilm on metal that will give superior photographic images with 16 mm. projection.

We are confident that when production is commenced the price will not exceed cellulose film, with the added features of strength, permanence and positive non-inflammability. The technique for developing will give the same speed and the use of the film in the projection

TABLE A

Results of tests made by Electrical Testing Laboratories, of New York City, at the request of Dr. Robert W. Carter, are as follows:

Material Submitted

One front-surface silver mirror covered with a protecting coat of lacquer; one strip of metal ribbon 35 mm. wide; one strip of exposed and developed 35 mm. film.

Test

The reflection factor of each sample was measured for an angle of incidence of less than 25°. Transmission measurements were made on the upper portion of one frame of film distinguished by the heading "Part I, Introduction".

Results of Tests

Sample	Transmission Factor	Reflection Factor
Front surface silver		0.94
Metal ribbon		0.89
Film	0.77	

Projectionists Acclaim

THE NEW AND REVOLUTIONARY PROCESS THAT EFFECTS A

20% Saving on Carbons!

No Drilling—No Extra Work—No Dirt

More than 600 Mid-West circuit theatres—including Balaban & Katz and Minnesota Amusement Co.—have been using Droll Patented Process carbons for 2 years—with complete satisfaction.

THE Droll Carbon Process is the first such to win complete acceptance by both projectionist and exhibitor—the former because it is the only such process to render absolute safety and satisfaction without requiring any extra work; the latter because it positively saves a minimum of 20% of his carbon bill.

Droll Patented Process carbons are now available to users of the following carbon trims:

SUPREX CARBON TRIMS

Negatives	*Positives*
6 mm. x 9	6 mm. x 12
6.5 mm. x 9	7 mm. x 12
7 mm. x 9	8 mm. x 12

AND the 13.6 mm. x 22 High-Intensity, machined for adapters only.

By the Droll Process, a carbon is so drilled on one end as to make a female opening; the other end is drilled for a male opening. The projectionist need only join the carbons together and clip them with a metal sleeve of pure copper —the same as the outside jacket of the carbon.

†U. S. Patent 2,120,243.

ALL DROLL PROCESS CARBONS REACH THE PROJECTION ROOM FULLY PREPARED AND READY FOR USE.

When the positive carbon is about 3 or 4 inches long, you simply insert the next carbon in the milled-out part, slipping the copper sleeve over the stub. This copper sleeve matches exactly the copper coating on the carbon. That's all there is to it—simplicity itself.

So pronounced has been the success enjoyed by this sensational new process that we invite all projectionists to try this type carbon. It will convince you of its absolute efficiency, ease of handling—plus at least a 20% saving. Write us today.

DROLL THEATRE SUPPLY CO.

Division of J. W. DROLL COMPANY

GUS ANDERS, MANAGER

351 East Ohio St. Chicago, Ill.

machine. We believe that 16 mm. projection machines for the future will be fitted with our attachment for opaque projection.

For schools, auditoriums, churches, *etc.*, metal film will mean absolute safety, superior projection, low costs for the film and unusual economy because of long life and permanence.

● Image Sound Quality

To return to the major motion picture field, the greatest number of questions centered on the quality of the image. Sound constituted the second leading question; and the third most important was: "What changes of equipment, technique, *etc.?*"

To the first question we should explain that an accurate photographic sound track on a smooth fine-grained highly reflective surface is a finer medium for sound reproduction than cellulose. In the celluose film the light is refracted in various directions while passing through the cellulose stock. It is well understood that background noises and lack of definition in sound is the basic reason why cellulose acetate film is not in general use, even with is safety factors.

With the metal film the beam of the exciting lamp is concentrated on the sound track at an angle of 25 degrees. The reflected light from the one-mill, slit passes through two condensing lenses to the photo-electric cell. The rest of the sound system is standard equipment.

The sound track on metal gives a clear sound reproduction free from fuzzyness and distortion. The fact that the light beam is reflected direct from the sound track without any interference is the reason for superior sound reproduction in the higher cycles.

A study of the last article together with the reproduction of the reflection test answers the quesion how first-class images are secured on the screen. It must be remembered that the highlights of the picture are the reflected light from the metal surface. This surface may give specular reflection or a diffused reflection, in the same manner that projection screens give specular or diffused reflections. The surface of the metal may be treated to give both types of reflection.

The shadow of the picture is the absence of reflected light in the same manner that the shadow is the absence of light by transmitted projection. We have thus only the fine gradations of tone between the highlight and the shadow for consideration.

In theory it would appear that we would lose detail because of the fact that the light must pass through the photographic emulsion to the deflecting surface and then back through the emulsion. It was supposed that this double passage of the light through the emulsion would affect our reproduction of the middle tones. We find in actual projection that the middle tones are rendered as accurately on the screen from opaque film as from cellulose film.

The question of scratching the image has occurred frequently. We might briefly say that the image may be hardened to any extent on metal, as the chemical reaction is only concerned with the emulsion, the metal not being affected by this group of chemicals. It should also be made known that tough transparent baking lacquers may be used on metal without affecting projection qualities. With the projection gate properly adjusted, we have not experienced scratching after prolonged use with metal film.

● Projection Optical System

Some readers still will be anxious to know what optical system was finally adopted in our first machine. We have reduced this to two reflecting surfaces plus the objective lens. This was possible only because the metal will stand high temperature, together with a mirror that has withstood the direct rays of the lamp for many operating hours without deteriorating.

In short, the light is reflected from the carbons direct to a mirror, from the mirror to the metal film at the projection gate, then from the lens to the screen. We have thus eliminated the two condensing surfaces. The mirror that we use gives us a reflection of 90 per cent. The actual light reaching the film is thus much higher than the light passing through the celulose film. The shutter and other factors on the machine are standard.

● Color Reproduction

It should be noted here that high intensity of light reflected upon the film predicts unusual reproduction for color. We have projected some color film, and we believe that with the cooperation of this section of the industry we will be able to show results with metal color film superior to nitrate film, with the added features of an almost third-dimension effect. We are preparing emulsions in the laboratory for experimental three-color film on 35 mm. film.

In conclusion we believe that we have established for all time the fact that metal film and the projection of metal film is now an accomplished fact. We submit that we have proved beyond any doubt the efficiency and economy possible in metal film.

We realize that our path has been a lonesome one and our progress has been slow and painful. The birth of our research dates further back than the inception of the motion picture industry. We have had little or no encouragement from scientists or technicians in our work.

We feel that we have made a major contribution to the technical development of a great industry. We are also justified in believing that we are making a permanent contribution to civilization with the perfection of a dependable permanent photographic film record.

The name of the first small company formed twenty years ago was Permanent Records Corp. We have not swerved from our first objective. We set out to develop a process for making permanent records on metal; whether this record might be a film for motion pictures or the reproduction of the lectures by Dr. Albert Einstein did not matter. The final goal was the same in either case.

The permanent reproduction of a photographic image on metal at a price compatible with modern commercial requirements marks the end of our research. The commercial development and exploitation we must rest in other hands.

U. S. Home-Defense Idea

Projectionist members of I. A. Loeal 440, St. John, N. B., have joined the Canadian Home Defense militia as searchlight operators. Two mornings each week are devoted to training, in uniform, in handling the big searehlights mounted atop buildings. Here's an idea for other projectionist units in eonnection with eurrent U. S. defense plans.

SIGNO-MARKER WINS FAVOR

That there is a definite need for a device to place clear, accurate standard changeover marks on film, was borne out at the I. A. convention at Louisville, where more than 200 delegates purchased Signo-Markers.

After giving this device the most rigorous tests, these delegates found Signo-Marker excellent for eliminating unsightly scratches, punch holes, pencil blotches, *etc.* on film prints. Signo-Marker places a clear, small circle on one to four frames in the standard dot position, and also outlines hard to see standard marks or places new marks where the originals have been obliterated.

Marked by Extreme Simplicity

Signo-Marker is constructed of a cast aluminum template and a hardened tool scriber which can be held in the hand or screwed to the rewind table. Offered at the extremely low price of $2.50, Signo-Marker is a piece of equipment that every projection room should have.

An illustrated circular is available free to I. P. readers from Clint Phare Products, 282 E. 214 St., Euclid, Ohio.

RCA SOUND SERVICE TOOLS

BY RCA PHOTOPHONE ENGINEERING STAFF

(The second instalment of this article appeared in July)

III.

WHILE listening tests in theatres are final criteria for good sound reproduction, very often acoustic response readings taken in the auditorium will indicate where changes are necessary to improve quality. RCA has employed the General Radio 759-*A* sound level meter (Fig. 9) for this purpose since the early part of 1937. In addition, it is extremely useful for checking noise levels in projection rooms and the theatre proper, for checking extraneous noise produced by fans in air-conditioning systems, and the effectiveness of vibration insulation of power equipment.

● Warble-Tone Freq. Reel

For checking acoustic response of speaker systems, a warble-tone frequency reel is employed as a source of signal, to reduce as much as possible the effects of standing waves in the theatre. The microphone is set up at various points throughout the theatre, and then readings are taken from 30 cycles to 9400 cycles at each station. The plotted curves so obtained indicate approximately the acoustic response in various sections of the theatre, and this can usually be confirmed by listening tests.

On the basis of the acoustic response so obtained, adjustments can be made for proper sound quality from the speaker system. This procedure has been used in numerous theatres and the results as compared to listening tests were very gratifying.

● Associated Equipment

This device is also very valuable in checking the sound distribution throughout the auditorium. Response curves run at several points quickly show up any deficiencies. The speakers can be accurately angled on the basis of such readings to give the optimum sound distribution.

Other test instruments have been developed by various branches of RCA for specific applications. These are often used for theatre work in routine service or solving special problems. One of these is the RCA vibration pick-up (Fig. 10). This unit, with its associated equipment, is very useful in locating defective gears, bearings, or other moving parts. Such defects usually show up as "knocks" occurring at regular intervals, or as vibrations at an audio frequency. If the approximate location and the frequency

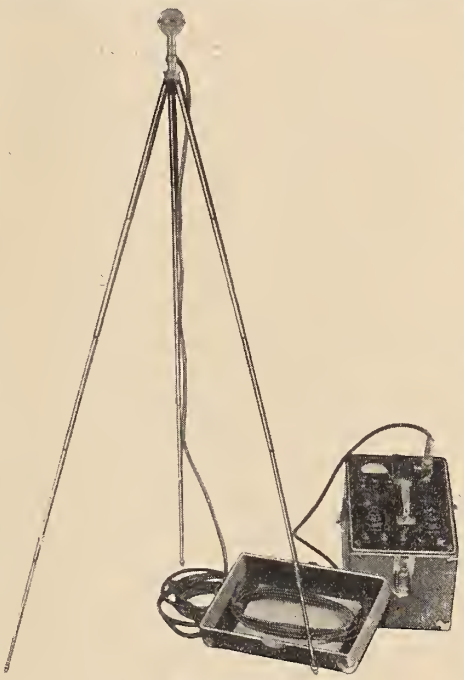


FIGURE 9
RCA Sound-Level Meter

of the "vibration" can be determined, the exact location of the defect is rather easy to find.

The output of this vibration pick-up is fed into an amplifier and in turn to the vertical plates of a cathode-ray oscillograph. A prod is provided on the vibration pick-up for prodding around the sound-head until the approximate source of the vibration is located, as indicated by a maximum deflection on the oscillograph screen.

If the frequency of this vibration or knock is known, the problem is still further simplified. The frequency can be determined by using the cathode-ray oscillograph externally synchronized by an audio beat-frequency oscillator or an RCA synchronizing generator.

If the synchronizing generator is used, it is coupled to the projector crank shaft or to a sound-head sprocket shaft. It generates a synchronizing voltage at intervals which are directly related to the r.p.m. of the shaft. The synchronizer also provides a movable marker voltage which can be impressed on the signal under observation and gives a means of marking the oscillograph trace with respect to the angular position of the shaft.

Knowing the r.p.m. of the motor and sound-head sprockets, the problem is still further reduced and can be solved by associating the frequency of knock or vibration with the r.p.m. of the moving parts in the vicinity of the source of vibration.

THE END

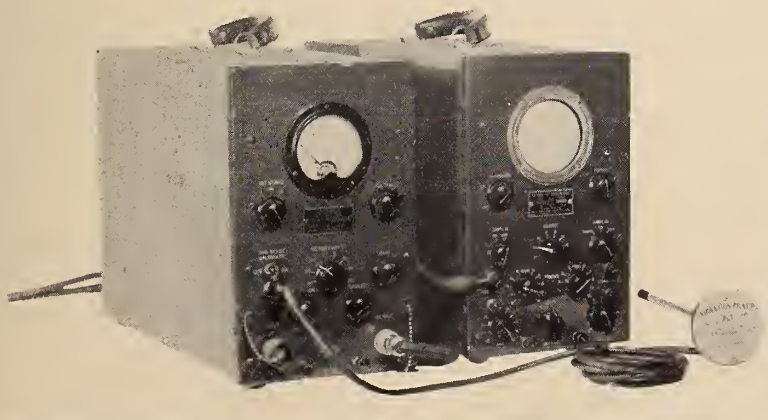


FIGURE 10
Vibration Pick-Up

SEES MODERATE BIZ GAIN

A "moderate gain" in film companies' net income in the fourth quarter is forecast by Standard Trade & Securities in its current survey of the film and amusement industries, published recently.

Increase is predicated on lower production costs and the expected larger domestic theatre attendance and receipts. Third quarter profits, however, are expected to be seasonally depressed and to reflect, as well the loss of British and other foreign business.

"Domestic theatre attendance continues slightly ahead of a year earlier, and the imposition of additional taxes on theatre admissions has had almost no effect on attendance," says the survey. "Theatre profits are also unaffected as, in over 90 per cent of all cases, the tax has been immediately passed on to the public. In a few instances, the opportunity was taken to increase admission prices by a few cents more than the additional tax. In general, however, there has been no increase in admission prices."

DENY PATENT SUIT DISMISSAL

Federal Judge John W. Clancy (N. Y.) has denied applications of Warner Bros., Albert A. Radtke, Radtke Patents Corp., and Leonard Day to dismiss the patent infringement suit of Photometric Productions Corp. against them. The suit covers a patent known as "Methods for and Means of Optically Recording and Reproducing Sound" without which it is probable sound films would not be in existence.

I. A. Local 257, of Ottawa, Canada, has made a voluntary contribution to the Canadian government for use in financing the war by the donation of the sum of $500 as an outright gift from its members.

Audience Noise *vs.* Volume Range†

By *W. A. MUELLER*
WARNER BROTHERS' STUDIOS

A series of noise measurements were made in theatres to determine the cause of low intelligibility of dialog recordings of wide volume range. Audience noise level was found to be a serious restriction, because it averages 8 db louder than film noise level and reduces the useful volume range by that amount. Audience noise is an extremely variable factor, as measurements made in the same theatre showed it to be as low as the film noise in one instance and later to rise 14 db above this value. To secure good intelligibility, the volume range of the dialog must be compressed so that the softest-spoken words never are so low in level as to be seriously masked by audience noise.

CONSTANT research and development by sound equipment manufacturers and motion picture studio engineers have resulted in the invention of noise reduction, quieter film stocks, better developing and printing machines, improved photoelectric cells, vacuum tubes, and other items too numerous to mention, each of which has contributed to a reduction of the reproduced noise level of the recording, and therefore an increase in volume range.

This fine work has resulted in an overall linear recording system with a greatly extended volume range, and scenes heretofore lifeless and flat can now be presented with greater emotion and realism, and as a consequence have greater dramatic value. The increased dramatic value of the wide-volume-range recordings was quickly realized by the actor and the director, and soon many scenes were being staged to take advantage of it.

When pictures recorded with this extended volume range were first released, sound engineers and theatre managers complained that these recordings were hard to understand. This factor of low intelligibility was not noticeable in studio review rooms and was not particularly bad in empty theatres; but in a theatre with an audience present there was considerable dialog that was hard to understand. This was not only true from scene to scene, but was even more disturbing in the loss of intelligibility from word to word.

Some words uttered by the characters on the screen could be clearly understood, while others seemed to be absorbed and entirely removed before they reached the audience. In effect, the audience was acting as a selective filter which suppressed certain words and permitted others to pass through to the listener.

● Varying Theatre Results

This was especialy pronounced at the end of the sentences where many actors have a tendency to lower their voices and trail off into almost inaudible sound.

In some theatres it was found that the intelligibility could be improved by raising the normal fader settings; but when this was done the louder sequences in the picture, particularly the opening title music, overloaded the amplifier equipment. In other words, the amplifier capacity of these theatre equipments was not adequate to reproduce pictures with a wide volume range.

In other theatres where adequate power was available, there was considerable audience annoyance because the high-level portion of the dialog became explosive and disagreeable and the actors sounded as if they were "barking" at one another.

The immediate remedy was to raise and lower the sound level manually, effectively reducing the volume range. While this necessary compression of the volume range was in direct contradiction to the premises on which the new recording system had been developed, there was no denying that the manually compressed dialog recordings had higher intelligibility and were less "explosive" than those of wider volume range.

Since this loss of intelligibility was not apparent in studio reviewing rooms, and was not definitely pronounced in empty theatres, it must have been due to the theatre audience and was undoubtedly caused by the masking effect of audience noise. That is, the audience noise was sufficiently greater in intensity than certain syllables or words of the dialog so as to make them unintelligible, or even to eliminate them entirely.

In other cases, entire scenes and sequences which were spoken very softly were so badly masked by audience noise as to cause complete lack of intelligibility and, consequently, the loss of the story sense of the production.

That the aforementioned explanation was true was not apparent even to the most experienced listener, and it was decided to make a series of noise tests to confirm this theory. Table A shows series of noise measurements taken in several theaters and studio review rooms, for this purpose. These measurements were made with a General Radio Type 759 Sound Level Meter, using the weighting networks as indicated.

● Representative Readings

The figure shown for each theatre represents the average of a large number of readings taken at different positions in the auditorium. Measurements

TABLE A. Theatre sound level measurements

Theater	Quiet (40 Db Weighting Network)	Ventilators on (40 Db Weighting Network)	Audience Noise (70 Db Weight Network)	Dialog Level (70 Db Weight Network)	Loud Music (70 Db Weight Network)
Huntington Park	+28.8 db	+30.5 db	+43 db	+64 db	+74 db
Granada	+23.7	+26.8	+41	+69	+73
Downtown	+25.2	+34.5	+43	+66	+74
California	+25.6	+29.2	+38	+60	+72
Mission	+24.3	+32.4	+44	+65	+72
San Pedro	+25.0	+28.3	+40	+62	+72
Hollywood	+24.0	+28.1	+44	+62	+76
Averages	+25.1 db	+30.0 db	+42 db	+65 db	+74 db
Studio Review Room No. 4		+26 db	...	+66 db	+76 db
Studio Review Room No. 5		+24	...	+65	+75

Zero Power Level = 10^{-16} watt per sq-cm.

†J. Soc. Mot. Pict. Eng. (July, 1940).

of the audience noise level were taken when silent trailers were being run or in a silent period between different portions of the show. A silent period of 30 seconds was secured by delaying the start of the next feature, keeping the house lights and the screen dark.

It should be noted that the noise level of the empty theatres is quite uniform, averaging +25 db. Also, the noise level is increased to +30 db when the ventilators are turned on. The noise caused by the audience, however, is surprisingly high, averaging +42 db and masking all other types of noise!

Audience noise also is subject to a wide vibration, rising to as high as +48 db at the end of the main feature when many people were leaving and entering. A measurement of +32 db was also obtained during a very dramatic sequence when the audience was unusually quiet. The figure of +42 db was the average of many such readings.

The average level for dialog was +65 db, and loud music reached a level of +74 db. The loud music consisted of opening and closing title music and musical numbers, which are the loudest portions of any sound film and are recorded at 100 per cent modulation.

These measurements show that a range of only 32 db is available between the loudest music reproduced in these theatres and the level of the audience noise. It has been found that the dialog should be at least 6 db above any noise level in order to be clearly understood. This requirement would mean that the absolute minimum level of the dialog should be +48 db. Since the maximum level in the auditorium which is attained at 100 per cent modulation of the film was +74 db, the usable volume range remaining is only 26 db.

● Lowest Permissible Level

This means that dialog which can be clearly understood in a theatre must never fall more than 26 db below 100 per cent modulation of the recording medium, as any words or scenes which fall below this level will be masked by audience noise and not understood. The only way that this permissible volume range for dialog can be increased is to reduce the noise level in the theatre, or to increase the maximum loudness that can be tolerated on dialog.

The audience noise level is very difficult to control and since psychological and physiological factors determine the annoyance caused by loud sounds, it appears that there is no easy way to extend this volume range.

Inspection of Table I shows also why the intelligibility of the high-volume-range recordings was not impaired in the studio review rooms where, without an audience, the noise level is at least 15 db below that of the average theatre. This results in a usable volume range of 40 db, permitting the low-level syllables, words, or scenes, which are lost in a theatre, to be clearly understood.

Several pictures were recorded and released with dialog of reduced volume range, based on the aforementioned analysis (see Table I), and excellent results were immediately obtained. Complaints on lack of intelligibility ceased, and the reports showed that cueing of the sound level of these pictures, in the theatres, was no longer necessary or being practiced. As a result the procedure was adopted universally for all Warner Bros.' releases, and at present the volume range of the *dialog* in our pictures is limited to 25 db. This restriction of volume range is secured by means of electronic compressers which are installed in all recording channels.

While it has been found impossible to use the full volume range of the recording system for dialog because of audience noise, the present dialog recordings are still of greater range than those formerly released, and many fine comments on their naturalness and dramatic qualities have been received.

● Various Relationships

It should be emphasized that only the volume range of dialog has been under consideration, and our conclusion is that there should not be more than 25 db difference between the softest whisper and the loudest spoken word. The relation between the loudness of average dialog and opening or closing title music or musical numbers, has not been discussed, but our measurements show that for Warner Bros.' pictures it averages about 9 db (see Fig. 1).

The producers and studio executives would like this figure increased; but so many complaints are received that the music is too loud whenever this is done, that a compromise has been made on the above figure. Many of these complaints come from exhibitors with old or obsolete sound equipment, which overloads on the high-level passages. Until these equipments are replaced, the dramatic effect desired by the producers can not be put into motion pictures.

There is also another serious limitation to the most dramatic use of sound in motion pictures, and that is because even our present recording systems do not have sufficient volume range to accommodate loud explosions, battle scenes, earthquakes, and so on. Many theatres with modern equipment cue these scenes by raising the level as much as 10 or 12 db, resulting in a much more dramatic and effective presentation.

In order to accommodate these sounds the level difference between normal dialog and 100 per cent modulation should be increased from 9 db to 20 db. The acoustic level of the loudest sounds could then rise to +84 db instead of +74 db as at present.

The sounds which would rise to this level would be sound effects only, as experience shows that audiences object strenuously to music which rises even 2 or 3 db above the loudness of present title music, *i.e.*, +74 db, as meas-

(*Continued on page* 23)

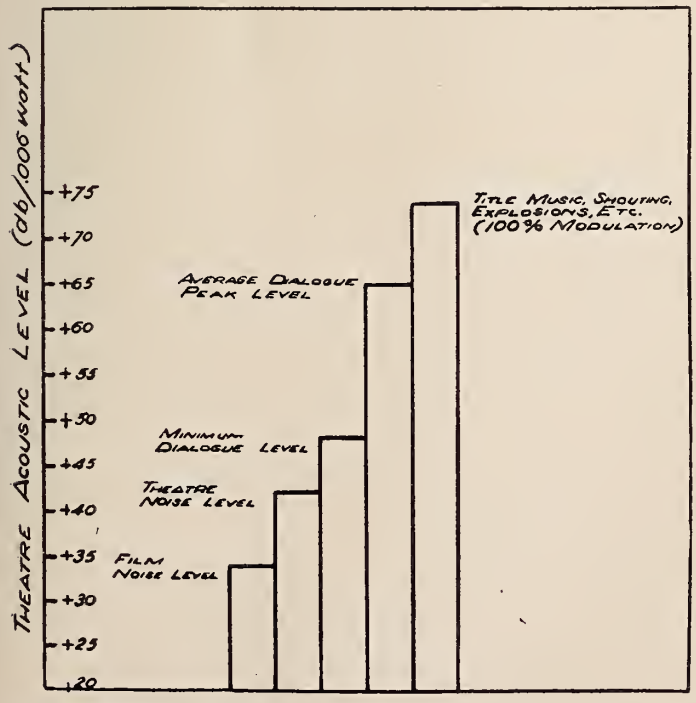


FIGURE 1

Volume characteristics of Warner Brothers' recordings

Commercialization of Non-Reflecting Surfaces

By ENGINEERING STAFF, NATIONAL RESEARCH CORPORATION

NO matter what the composition of a piece of glass may be, or how carefully it may be prepared, approximately four per cent of the light incident upon each surface is reflected and irreparably lost.

Four per cent may seem like a small figure, but it must be remembered that any sheet of glass or lens must obviously have not one but two surfaces. The total transmission, therefore, can never exceed 92 per cent, no matter how clear and optically perfect the glass may be.

Most optical instruments are composed of many sets of various and sundry complicated lenses. The better camera lenses generally have at least three separate lens components with six "glass-air" surfaces. In such a system, therefore, 78 per cent of the transmitted light is lost by reflection.

In the optical systems as used for some systems of sound recording, complicated range finders, gun sights, medical instruments, *etc.*, as many as 5 to 10 individual lenses may be required, with resulting losses in light transmission of from 35 to 55 per cent.

● The Treatment Process

It has now been experimentally demonstrated that, by a rather complicated process, any glass surface may be treated under high vacuum and made substantially non-reflecting and the much publicized "invisible glass" thus produced. The technique employed involves producing a coating of suitable materials such as magnesium or calcium fluoride on the carefully prepared glass surface.

Offhand, this might seem like a relatively simple procedure, if it were not for the fact that the coating is deposited by distillation under an extremely high vacuum, that is, a pressure of less than .000001 mm. of mercury equivalent to less than 1/10,000,000th of atmospheric pressure.

Quite aside from the problems involved in producing pressures of this type, a second condition must be met in order to prepare non-reflecting surfaces. The material with which the glass surface is covered by high vacuum distillation or "evaporation" must be deposited in a carefuly controlled manner to a thickness of one quarter the wave-length of light. In terms of units with which most people are more familiar, this means the deposition of a coating which is only 5/100,000th inches in thickness.

When these conditions are satisfied, amazing results are achieved. A single lens which normally transmits only 92 per cent of all light that strikes it now transmits about 99 per cent. Eight lenses in series, which together normally waste half of all the light that is received, have a transmission of 92 per cent after treatment.

● Varied Applications

It is still too early to predict the myriad uses to which this intriguing process may be applied. Immediate applications suggest themselves in connection with the design and manufacture of optical apparatus. The treatment of range finders, binoculars, telescopes, bomb sights, and similar equipment may be of immediate interest.

In aerial photography, for example, questions of "resolving power" of the large complicated lenses are particularly important in order that the maximum amount of detail may be recorded. Here another advantage of "non-reflecting surfaces" becomes apparent, namely the elimination of multiple reflections within the camera lens. Such reflections, known to the optical worker as "flare," always tend to produce pictures of limited clarity lacking in sharpness of detail.

The treatment of lenses used by the motion picture industry should be an aid in maintaining the high standards already established. Not only is it possible to enhance the clarity of original negatives, improve the quality of release prints and the recording and re-recording of sound tracks, but projection lenses may be treated in order to add still further to technically perfect screen reproductions.

One of the probems that television engineers find ever present is that of obtaining sufficient illumination on the subject during "telecasting." In order to obtain sufficient illumination, extremely high aperture lenses have naturally been employed. By treating the television camera man's lens, an increase in light-gathering power can be effected.

Both television and the technique of producing non-reflecting surfaces are still too new to predict how these new fields may develop. It is safe to say, however, that wherever questions of light and optics are of importance, non-reflecting surfaces will of necessity play an important part.

● General Commercial Use

Other less immediate applications of this new technique may eventually be of tremendous importance when extremely hard and resistant coatings are produced economically on a large scale. The problem of reducing annoying reflections from store-front windows and other large glass surfaces has long intrigued many investigators. In terms of volume, the largest single use of glass is for such purposes, and eventually "invisible glass" may find its way to the shop-front window.

All wearers of glasses are well acquainted with the annoyances which result from reflections which, under some conditions, become so troublesome as to make the wearing of glasses literally impossible. Those who of necessity wear extremely thick or highly curved glasses, are conscious of the fact that under adverse lighting their eyes are rendered invisible or at least distorted because of troublesome reflection. Here again it is hoped that interesting results may be obtained.

The process of coating "non-reflecting surfaces" by evaporation of certain chemical salts under high vacuum was originally developed by scientists working at the Massachusetts Institute of Technology. National Research Corp. is engaged in research and development in the fields of physics and chemistry, particularly in connection with commercial applications of high vacuum. This organization is now prepared to produce non-reflecting surfaces on a commercial basis under a license obtained from Research Corporation, to whom patents on this process have been assigned.

TELEVISION-FILM TIE-UP SEEN BY FCC COMMISSIONER

That the motion picture industry will be an important factor in the future of television, both as a production source and as a medium for viewing television programs, was indicated by FCC Chairman J. L. Fly, who recently visited Coast studios.

"I think," he said, "that we may have laid too little emphasis on the production phase of television and may have overlooked the vast facilities motion picture people have to offer. There is no doubt in my mind that the industry could do a far better job of television production than could the broadcasting industry, and that the future of television could not possibly help being united with the film industry."

The FCC chairman added that his visit to the Coast studios had led him to give further consideration to the possibility of the exhibition of television programs of sporting events and news of national interest on theatre screens.

FILM BOW-OUT BY C.I.O.

Last vestige of C.I.O. opposition to I. A. in amusement field disappeared when it was announced that charters granted to projectionists in several theatres in Scranton, Pa., area had been revoked, with the explanation that C.I.O. is "no longer interested". Theatres affected had been picketed by I. A. units for employment of "non-union" men.

The Theatrical Managers, Agents and Treasurers Union, of New York, has dropped the "treasurers" from its title, that division having come under the jurisdiction of the I.A.T.S.E.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

HERE'S one for the book! When No. 2 machine at one of my theatres was operated, a sharp static snapping sound came through the sound system at irregular intervals. These sounds would vary in intensity and in frequency. After making a number of fruitless experiments, such as grounding, *etc.*, the following work was done, which finally cleared the trouble:

The machine was run first for five minutes with film in normal dry condition, and then for ten minutes with the same reel of film coated with Simplex oil on its surface. The oil coating was used to form a path for any static charge which may have been present.

Results: Noise was present while dry film was running through; but noise was not present while oil-coated film was running through.

The rotary stabilizer was then taken apart and the bearings were found to be very dry. After bearings and scanner shaft were cleaned and well oiled, the machine was operated under normal operating conditions with a 20-minute reel of the same feature, and the noise had entirely disappeared.—W. V. HOWARD, Altec, *New York.*

• • •

In severe cases of motor noise transmission, particularly in those cases where the vibration is being set up from the room floor and transmitted below to either theatre foyer or auditorium, I found that the use of two 25-cent sponge rubber chair pads obtainable from Kresge's will make enough padding for reproducer legs.

A small piece of Ozite, the same size as the sponge rubber, should be placed on the floor, then the sponge rubber on top of it, and then the reproducer base leg mounted on top of the sponge rubber. The Ozite lessens the flattening of the sponge rubber and protects it from immediate contact with the floor, where oil is often picked up.

This method has been found to provide excellent results in those extreme cases where cork cushions would not correct this condition.—F. E. GAMMON, *Altec, Detroit.*

• • •

I noticed a low noise on one machine, very much like sprocket hole noise, noticed only on silent sequences. In an effort to locate it quickly, the test amplifier was connected to the output of the 49 Amplifier—this gave a chance to check No. 1 even with No. 2 running.

It was quickly discovered that the trouble still was present with the exciting lamp blocked off. Accidentally, I noticed that the noise coming through the earphones connected to the test amplifier was increased when the input connection to the test amplifier was connected directly to the universal base. The amplifier was also grounded to the same base. Any place on the base, even the same point for both input and ground, gave the same result.

From then on it was easy to locate the trouble as a brush in the arc control. Even though lamps are only a year old, the brush was chattering and arcing sufficiently to set up a small disturbance. This was evidently being fed through the ground of the system rather than a spark disturbance, as No. 2 machine was quiet as a mouse.—J. M. SANFORD, *Altec, N. Y.*

• • •

Encountered an unusual case of trouble recently. A clicking noise in the sound was traced to stripped threads of the p.e. cell anode terminal in the W.E. universal base. Replaced connecting block and secured it tightly, which eliminated noise.—C. W. HILLIARD, *Altec, New York.*

• • •

Here is a method which has been successfully used for speedy replacement of a Simplex intermittent movement:

With the lower half of the rear projector doors removed or hinge screws removed, you can loosen the G-112-G drive gear clamp screw and permit the gear to move about a quarter of an inch towards the main soundhead and projector drive gear assembly.

By then removing the screw in the intermediate gear and tapping or pushing the shaft through to the film side you will find that after loosening the clamps on the intermittent movement you can easily remove the movement by shifting the intermediate gear to the left side in so doing—or even remove the intermediate gear. To reinstall, simply reverse the process.

By this method a movement can be replaced in a very few minutes.—M. E. PICKRELL, R.C.A., *New York.*

• • •

Projectionists often use headsets to test for noise and other trouble during the running of a show. This is a very good idea inasmuch as the headset will shut out the high noise level of rotating equipment which makes the regular monitor speaker useless for this purpose. It is not uncommon that exposed wiring and leads to the headset short-circuit due to normal wear, and cause a sound outage.

The installation of protective resistors will eliminate trouble if shorts or grounds in this wiring occur. For protection, it is best to install them inside of the final amplifier. Connect one resistor in series with each leg of the wiring to the headset. Use 500-ohm resistors for low-impedance outputs, and 5000-ohm resistors for 500-ohm outputs. Attenuation to the headset will be negligible, if used with 2000-ohm headsets.—F. J. RAUFER, R.C.A., *Atlanta.*

• • •

For protecting modification nameplates, sprocket strobodiscs, *etc.*, a very efficient and convenient liquid can be obtained in the form of a clear nail polish. This is actually a high-grade clear lacquer, impervious to oil, which comes in small (10c) bottles equipped with a usable brush.

There is also a new product, called "Liquid Thread" made by the Paste Elastic Mfg. Corp. of Akron, Ohio available in some of the Woolworth stores. This is a rubber-base white liquid that comes in a convenient bottle with a brush and is excellent for firmly applying small labels, where there is no oily condition. It is usable on a very wide range of materials.—F. J. PFEIFF, Altec, *New York.*

• • •

The selector switch for the meter in ERPI 86 type amplifiers accumulates a coating of dust and oxidation every few months. This can be removed by flushing the contacts with carbon tetrachloride (NOT fire extinguisher fluid) and applying a light coating of Daven oil after the tet has dried. If care is used in applying the tet, no harm will be done the wiring. I find a small oil can ideal for the job.—C. J. FAULSTICK, R.C.A., *Atlanta.*

• • •

A projectionist in one of my theatres uses an old stunt to make adjustment of the lenses in an RCA PG-13 equipment, old type 4 PS-16-A1 sound head. By blowing smoke in the sound compartment

the light beam stands out clear and defined so that the lens can be focused by eye. This method gives accuracy to within 4-6 db at 8,000 c.p.s. on an average and is invaluable should adjustment be necessary when regular means are unavailable.

Here's something else. He also states that in case of emergency, should the relay fail on a Peerless l.i. arc control, the whole relay control can be removed and a 250-ohm, 50-watt variable resistor used in the motor circuit with excellent results. — J. M. SANFORD, Altec, *Utica, N. Y.*

[Ed.'s Note: *Such reticence! Would it be violating a confidence to let us have the name of this versatile projectionist?*]

• • •

If a projectionist finds it necessary to clean his projection lens during operating hours and wishes to avoid the focusing of a lens during the show, it can be done in the following way. Replace the film with a white thin sheet of paper in the aperture compartment. Using the projector head as a camera, focus the lens on the screen while the other projector is in operation. When the image on the white paper is clear, the lens will be in focus for projection. — S. S. LEBOW, R.C.A., *New York.*

• • •

The stork dropped "a bundle of static" at the home of V. A. Carpenter, Altec serviceman in Indianapolis. It's a boy.

• • •

Most service inspectors fasten a small strobodisc onto the projector main drive shaft to assist them in regulating projector and sound head speed. Fastening the strobodisc is often a problem. The drive shaft is generally covered with oil, and no matter what one does, the disc always seems to come off.

One way of getting away from this difficulty is to fasten the strobodisc on to a small magnet. The magnet can then be placed against the face of the drive shaft or its sprocket and will hold the strobodisc in place. This gadget is one of the handiest things imaginable. It can be carried around in the pocket and be fastened onto any projector without difficulty.—C. W. SCOTT, Altec, *Minneapolis.*

• • •

One never knows just what is going to happen. I tried to use my AA-1000 emergency amplifier to check the transcription equipment at a radio broadcasting station but I picked up another broadcasting station's program!—D. M. COLE, Altec, *Newark, N. J.*

• • •

A simple and inexpensive way to prevent dust from collecting on the lens front while you are away from the projection room: purchase a few oil silk jelly glass or refrigerator bowl covers from the 5 & 10. The covers have an elastic band and will snap neatly and tightly over the lens barrels.—J. P. WARE, R.C.A., *Pittsburgh.*

• • •

I have eliminated projection room telephone troubles in several of my theatres by digging up some unusued copper-oxide trickle chargers, which, with a resistor, condenser filter and voltage-dropping circuit, is used to replace the present dry cells.

In this way, with a more constant voltage, I have eliminated the necessity for readjusting the buzzer and, also, have cured the tendency of the phones to lose sensitivity.

I have also one theatre with a power unit where the monitor field is a separate circuit from the stage units, and I have used a part of the voltage across one of the resistors in series with monitor field to secure a supply for the projection room phone set, properly fused and filtered, which is working out nicely—no trouble being experienced and eliminating further battery replacements. — B. P. SCHRODER, Altec, *Atlanta, Ga.*

• • •

Here are a few experiments anent T. H. Carpenter's item in the June issue of I. P. relative with regard to the effects of Summer heat on condensers.

A theatre in Louisville has had six condensers fail in the last year. This amplifier is located in a small room with very poor air circulation resulting in a high operating temperature. About four months ago I cut an opening in the top of the amplifier case about 5 x 11 inches and covered it with a fine wire screen. This allows better air circulation through the unit and lowers the operating temperature several degrees.

No trouble has been experienced since, and I believe the decreased temperature is responsible. I have noticed that most of the defective condensers have been hot enough to allow some of the sealing compound to leak from the metal case.—F. H. RIFFLE, Altec, *Louisville, Ky.*

• • •

Evidently no amount of preaching and pleading will eradicate the evil of open portholes which allow projector noise to escape into the auditorium and distract the audience. However, here's a good idea that might be tried by every projectionist who faces this problem.

There are one or two theatres in my territory where, due to poor ventilation in the projection room, it is necessary to keep the portholes open, or at least one of them, so that air may be circulated a bit. This is sufficient to allow considerable room noise to escape and be heard in the house.

I suggested that it be eliminated by lining the portholes with ½" Celotex and placing several baffles in the nature of frames approximately 1" wide around the portholes at spaced positions along the porthole. This will naturally cut down the size of the port, and if such cannot be permitted, the porthole may be extended by the construction of a chute and eliminate the baffles to accomplish practically the same results. This treatment served to cut down considerably the noise from the projection room, and is nothing more than a muffler principle.

It was also noticed that in many cases where the projector heads were noisy some sound was audible, even where there was glass in the ports, the trouble being that the glass acted as a diaphragm and transmitted the sound from the head very easily. This was cut down considerably by the lining of the ports with Celotex and similar construction as mentioned previously and by placing a Celotex frame adjacent to the glass to prevent vibration.—W. H. LEWIS, *Altec, Michigan.*

• • •

When one rectifier tube of the Tungar type quits rectifying in an arc lamp rectifier or sound system power unit, the

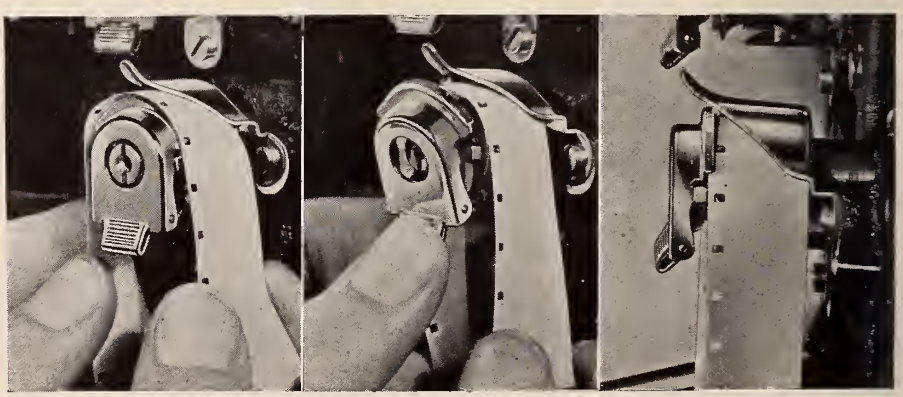
(*Continued on page* 21)

B. & H. Announces Changes in Filmosound Projector

BELL & HOWELL has announced two sweeping changes in Filmosound design, developments said to be the most significant advances in projector design in some time. B&H claims to have devised sprockets and guards of such types that the film cannot be threaded incorrectly, in addition to a new take-up mechanism which winds the projected film with constantly correct tension regardless of the reel size or film load.

As the Filmosound is threaded, the new "Safe-Lock" sprocket guards, which are standard equipment on all models, guide the film to its proper position on the sprocket. The spring-mounted guard is snapped open and immediately closed, and the film is threaded, locked safely in place.

Furthermore, the new guards extend over the outer edge of the film. This construction, it is claimed, prevents defective film, or splices incorrectly made, from jumping the sprocket. The new sprockets are made of hardened steel, which radically reduces wear.



Left to right: film approximately in place on sprocket; guard snapped open, film seated correctly on sprocket teeth; guard closed, for projection.

The Projectionis 's Interest In Auditorium Viewing Conditions†

By *BEN SCHLANGER*
CONSULTING ARCHITECT, N. Y. CITY

Auditorium viewing conditions and screen considerations should justly be the concern of the projectionist. The following factors beyond the confines of the projection room should be of interest to him: (a) screen size, (b) screen lighting, (c) screen border, masking, and immediate surroundings, (d) position of screen.

The paper discusses these items, giving recommendations that should facilitate the projection of high-quality motion pictures.

IF THE projectionist intends to carry out his work successfully, he must realize that the scope of his work does not begin and end with the operation and care of the electro-mechanical projection equipment. There is much more detail to be considered that can be found beyond the confines of the projection room which will affect the quality of the picture presentation.

Auditorium viewing conditions and screen considerations should justly become the concern of the projectionist because any compromise in the quality of the presentation will only diminish the effect of the good work he otherwise performs. It is not necessary to increase the amount of work performed by the projectionist to broaden the scope of his work; it is suggested merely for him to be observant of the conditions he is given to work with and to report to his superior all existing deficiencies.

By the time the projectionist appears on the job it is usually too late to make fundamental changes in auditorium design and lighting, but the projectionist may be able to point the way toward making the best of what he is given to work with. Glaring errors may be corrected without too much difficulty in many instances because of some advice given by the projectionist. Exhibitors could thereby, through their projectionists, be made conscious of better projection and in turn eventually be guided in building more scientifically correct auditoriums.

● Items Outside Room

The following considerations beyond the confines of the projection room seem to be of direct concern to the projectionist:

(*a*) Screen size. (*b*) Screen lighting. (*c*) Screen border, masking, and immediate surroundings. (*d*) Screen position.

While acoustics and seating arrangements may also add or detract from the work of the projectionist, he can not do much to change conditions in these instances and neither can he be equipped to deal with such detailed specialized work. But it is his duty to point out those faults which may come to his attention with regard to these aspects.

There is much work now being done to determine the requirements for desirable auditorium viewing conditions, but until such time when definite standards will be established, it is possible for the projectionist to make recommendations which will at least correct such conditions which are definitely known to be undesirable.

Although an attempt will be made here to give information to the projectionist as to the faulty conditions which are to be avoided, it should be pointed out that more detailed information should be made available to him so that he may improve his service to the best possible extent. Tolerable ranges and other recommendations for items *a* to *g* given hereinafter will be of use to the projectionist if intelligent application of the information is applied.

For example, the proper selection of a screen size taken from within the recommended range of sizes given depends on the possible treatment and provisions which can be made for the other listed considerations. Following is a list of recommendations and suggestions for their practical application:

● Screen Considerations

(*a*) *Screen Size.*—A width no greater than or less than dimensions calculated by using the divisors from 5.2 to 5.8 with the distance from the screen to the last row of seats being the dividend.

(*b*) *Screen Lighting.*—Ten foot-candles of incident light or more measured as an average lighting for the entire area of the screen, allowing a maximum differential of thirty per cent between the edge of the picture and the center portion.

(*c*) *Screen Border, Masking, and Immediate Surroundings.*—The screen masking is a light-absorbing band of material placed at the extreme edge of the picture on all four sides for the purpose of eliminating the appearance of the fuzziness found at the edge of the picture.

The screen border is a band of material forming a frame around the picture immediately outside of the making frame. This material need not be light-absorbing or dark in color. Its relative size, color, and degree of darkness vary in accordance with the auditorium design and the particular approach made as to the psychological aspects of the picture presentation. Various types of illuminated screen borders are being experimented with.

● Seating Governs Position

The immediate screen surroundings constitute those ceiling and wall surfaces which come within the range of vision of the patron while viewing the picture. These surfaces should have a finish and color which will control the amount of light re-reflected from the screen. They should also be uniform in texture and without surface breaks or painted decorations which would create shadows or contrasting areas of reflected light. There should not be any spots or isolated areas of secondary illumination on these surfaces. The aim here is to create a neutral and undisturbing setting for the projected picture.

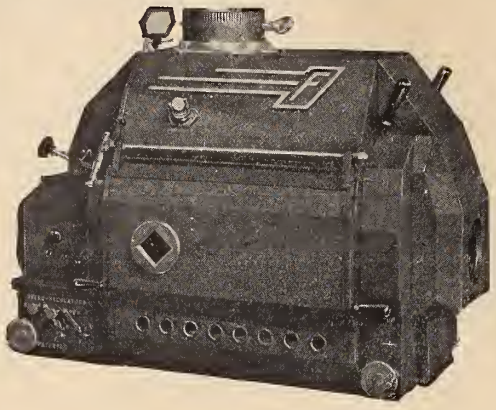
(*d*) *Screen Position.*—The screen should be centered in relation to the seating width and not to the physical width of the auditorium structure. A maximum possible distance is desirable from the screen to the first row of seats. The distance between the floor and the bottom of the picture is sub-

†J. Soc. Mot. Pict. Eng., June, 1940.

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ject to the relationship between the picture size and the distance between the first row of seats and the screen.

Six feet is a maximum from floor to picture bottom when the picture width is equal to the distance from the first row of seats to the screen. This height may be increased 2 inches for every increase in distance from the first row of screen equal to one-eighth of the picture width.

(*e*) *Screen Material.* — Durability, efficiency in light reflection, degree of light diffusion, and sound transmission are the factors controlling the selection of proper screen material. Screen costs should be considered as to the cost per year rather than by the initial cost. *Resurfacing of screens should be limited to one time.* Where screens are especially subject to atmospheric discoloration it is desirable to use a screen material inexpensive enough to warrant frequent replacements. For example, there is now available a satisfactory paper screen which would suit [illegible]ose.*

The considerations listed under *a*, *b*, and *c* are definitely related to one another. For example, the minimum amount of incident light recommended on the screen would apply to the ratio given as 5.2 under the *a* heading, the amount of incident light required under higher ratios being greater in proportion to the increase in ratio.

The aforementioned ratios also control the width of the masking explained under heading *c*. This width should be an absolute minimum, unless the ratio happens to be 5.3 or less. The width can be as little as 3 inches to destroy edge fuzziness. Larger masking widths tend to make the picture appear small from the rear half of the seating. Wide maskings are especially undesirable when colored films are projected.

The screen border referred to replaces the area normally occupied by dark masking material. It is especially desirable when the picture width is ½ or less than ½ of the auditorium width and when the ratio heretofore mentioned is 5.3 or more, such instances in which auditorium proportions tend to diminish the apparent picture size.

*ED's NOTE: Term "paper" used to describe this screen is inaccurate; it's really a plastic.

ACADEMY PREVIEW STANDARDS

The Research Council of the Academy of M. P. Arts and Sciences is distributing to interested theatre operators copies of Specifications for a Standard Preview-Theatre Auditorium Fader and a Standard Preview-Theatre Variable Equalizer. These specifications were drawn up by the Theatre Sound Standardization Committee and approved by the Council August 14, 1940 for

use by all studios in all preview theatres.

The use of this new standardized equipment by all studios in all preview houses will eliminate the necessity for each studio independently adjusting the theatre equipment for each preview by providing adequate adjustable equipment control in each house.

BELL LABS.' IMPROVED HEAVY-WATER ROCHELLE-SALT CRYSTALS

THE piezo-electric effect in Rochelle salt* has found practical application to some extent in microphones, receivers, phonograph pick-ups and electric filters. A limitation of its use, however, has been the rapid loss of the piezo-electric properties above temperatures of 75 degrees F.

A. N. Holden of the Bell Telephone [illegible] have recently found that Ro-

[illegible]

of the magnetic [illegible]

ferromagnetic materials. Below a certain critical temperature a ferromagnetic material has been shown to consist of small domains, each spontaneously magnetized but with the directions of magnetization of the many domains so distributed as to produce no net magnetization.

Rochelle-Salt Characteristics

A Rochelle-salt crystal, similarly, in its anomalous temperature range, has been shown to consist of small domains polarized in two opposing directions. The process of charging the material in bulk, by an applied electric field, consists largely in reversing the direction of polarization of these domains.

The much higher internal damping and the variation with temperature of the natural frequency of vibration of bars of Rochelle salt make it very unlikely that the material could replace quartz, the other well-known and widely applied piezo-electric material. Extending the useful temperature range of Rochelle-salt crystals, however, will broaden their usefulness in fields where they are effective.—*Bell Laboratories Record.*

*I. P. readers will recall the several articles by engineers of Brush Development Corp., which has had such success with these crystals.

AT YOUR SERVICE

(*Continued from page* 18)

wrong tube is frequently picked as the defective one. Of course, if the filament and plate are plainly visible, the good tube is the one which shows a blue glow around the filament.

In many rectifiers both elements of the tube cannot be seen because of position of tubes, or because of coating on the bulbs. In these the defective tube can usually be picked by the yellow glow in the tube which makes it look much brighter than the other. If an A.C. voltmeter is handy, another check can be made by testing the voltage from plate to filament. The defective tube will show the higher voltage. —R. O. NORTHROP, R.C.A., *New York.*

• • •

Had been visiting a house on and off equipped with a Simplex E type sound system attempting to promote a service contract and found they have been experiencing trouble with their exciter lamp holder. The complaint was, "The exciter lamps go out." Tried new exciters in the holder and found that they would not light. The trouble in this case was as follows:

In the Simplex E parts list note the picture of the SH-2028 exciter lamp bracket. Items SN-280 and SN-289 are the spring plate and the plate to make contact on the lower stud which holds the SH-2028 exciter lamp bracket. This lower stud is shown on the picture of SH-2033 sound

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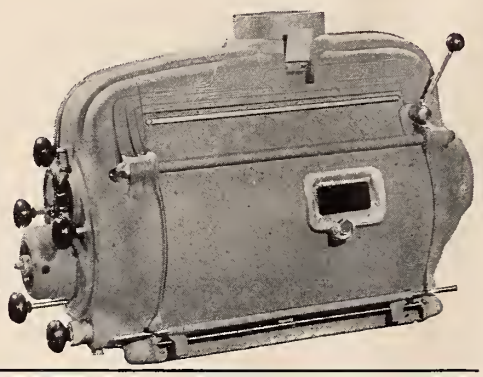
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bracket assembly. It will be noted that the stud is larger at the front end than at the rear. Lack of proper contact was occurring at the narrow portion of the stud. By reforming the SN-289 plate to make proper contact, all was well.—H. M. SMITH, Altec, *Chicago, Ill.*

• • •

More about blinking exciter lamps on Simplex E Systems. The trouble is inside the tip which makes contact to the exciter lamps: the tip is squeezed onto the wire. Put it off, drill it out and solder back.—V. A. CARPENTER, Altec, *Indianapolis.*

[Ed.'s Note: *The need for making the adjustment mentioned in the foregoing two items no longer exists, corrective measures having been applied by the manufacturer. In fact, this circumstance prevailed in only a few of the earlier E systems—as is the case with practically all new projection and sound units, which are subject to certain minor adjustments following "shake-down" trials under actual operating conditions.*]

• • •

Many projectionists do overhauling on projectors, and during this work a small high-speed grinder that does not cost much is desired, and some times necessary, so that fitting of the star wheels and cams of intermittents can be done correctly. In almost all projection rooms there is the means for this grinder at a very small cost—the old discarded electric razor, one that has a rotary motor and not a vibrator is necessary to make the grinder.

A small chuck with emery wheel of the desired size can be had from a dentist or jeweler supply house, the motor dismantled, and the motor shaft drilled to take the chuck shaft. This can be drilled and tapped or pinned as desired. Some motors extend through the end of the cases and others through the side, but in either case the chuck can be mounted by drilling through the case for the shaft. This tool is very handy for small accurate work around most any kind of machine work.—H. B. DAVIDSON, R.C.A., *Atlanta.*

SAVE CANADIAN WAR JOBS

Canadian members of the IATSE who enlist for active service in the war will be guaranteed good standing in the union until they return to civilian life, it was announced in Toronto. This policy has been adopted for stagehands, electricians and other organized employes of recognized theatres in Canada as well as the projectionist members of IA locals.

The practice was followed in the last war, and this time it will be applied to those who undergo lengthy periods of enlistment in Canada under the compulsory service plan as well as to those who have joined up voluntarily with home defense units.

AUDIENCE NOISE vs. VOLUME

(*Continued from page* 15)

ured in the auditorium of the theatre. The lowest dialog should not fall below +48 db or 6 db above audience noise, and it should be compressed into a 25-db range. The film noise should be 8 db below the audience noise, or at a +34-db level, so that it does not contribute materially to the noise level of the theatre.

● Recording Volume Range

The volume range of such a recording system would be 50 db, and this should be secured from prints after a number of runnings in theatres, and not as they come from the release laboratory. This would be a 10-db improvement over the volume range of our present recording system, which averages 40 db, based on the noise level of prints after numerous runnings in theatres. Such a new recording system would meet every demand of the producers and exhibitors, but recordings made in this manner could not be reproduced on the obsolete, under-powered equipment now in many theatres.

Studio sound engineers and equipment manufacturers are diligently working to perfect such a system, which when developed will further enhance the dramatic possibilities that sound has given to the motion picture.

Discussion:

MR. ALBERSCHEIM: Have other studios, using other recording methods, had the same experiences with the audience, and is the wearing of film, as well as the masking

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of the audience noise, selective to the recording methods used?

MR. MUELLER: We experienced this difficulty only when we began using a recording system having available a wide volume range. We were impressed with the dramatic results of these wide-range recordings, and began releasing pictures in the theatres with the results outlined in my paper.

In order to determine why this effect had not shown up in our previous recordings with the variable-density system, we measured the volume range of a number of our pictures previously released and found that they were compressed into a narrow volume range much more restricted than I recommended in my paper. This was found to be true also of the recordings of all producers using variable-density sound and can be very easily verified by anyone with a true instantaneous peak-reading volume indicator such as the neon volume indicator which we use.

As previously pointed out, a variable-density recording with the same percentage modulation should be about 8 db lower in level than a variable-area recording. The variable-density recordings being released in Hollywood at present run on the same fader settings as our variable-area recordings, indicating that the limiter-type compression is still present, and peak-reading volume indicator measurements also show that the variable-density pictures still have the greatly restricted volume range.

Consequently, producers using variable-density records have not had this difficulty because their recordings are compressed more than the ranges rcommended in my paper, with the consequent penalty of serious overloading not present in properly produced variable-area recordings.

More Theatre Sound Absorption

MR. KELLOGG: I gather that there is not much that can be done toward reducing audience noise. Presumably that is true from the standpoint from which the paper is written, namely, what can the producers do about it? However, there is no question that greater sound absorption in the theatres would very materially reduce audience noise. The audience is competing with itself to be heard. People talk to each other, and the louder the noises from other sources, the louder they talk.

There is further quieting of the audience due to the psychological effect of removing sources of noise, such as ventilation systems, and of reducing noise by means of absorption. I should think that the possibility of increasing the volume range by means of sound absorption and making it up by more output in the sound system certainly looks hopeful.

DR. GAGE: In the reviewing rooms would it be desirable to have a sound-source equivalent to an audience, so that the reviewers might judge whether the dialog in the films was of correct volume to be intelligible in spite of this interference?

Nixes Reduced Signal Level

MR. RYDER: It is very difficult to judge playing levels in a review room where one is deprived of audience reaction. I have been following previews ever since the advent of sound, and even now I find that I miss in level settings prior to the first preview. I still depend upon hearing the picture with an audience for the establishment of the proper playing level.

MR. MUELLER: The measurements were

averages of tests made in a number of theatres with different types of audiences and different types of pictures. Audience noise varies with the type of audience, the type of picture, and the scenes in the picture, and as stated in the paper, noise levels were found as low as +32 db and as high as +48 db.

We can not make our pictures to suit the best or the worst noise conditions prevailing in the theatres, and we selected an average noise level as being the most logical compromise.

I do not agree with a suggestion that has been made that the signal level be dropped 12 or 15 db below the audience noise. An audience may quiet down 5 or 6 db for a dramatic, low-spoken scene if the scene is not too long. However, as soon as the scene is over, the noise level will rise above normal as the people readjust themselves in their seats and make themselves comfortable again.

Any producer who released pictures based on the premise that the audience must be very quiet to enjoy them would be facing disaster. It has been our experience that the product must be fitted to the requirements of the average theatre and theatregoer rather than that the audience must be conditioned or educated to suit the picture. We know of no formula to make an audience behave in a manner to suit the ideas of a producer of pictures.

MR. ALBERSCHEIM: The wear of a film depends upon the type of track and other factors. Also, as has been pointed out, audience noise is selective to the dramatic content of the story, and perhaps in some theatres, if the story is a good one, the audience noise may be found at a level of only 32 db. Have other studios had the same experience with regard to volume range, or have you been able to put more volume range on your film without difficulty?

Defective 'Cleaning' Processes

MR. RYDER: Actually we have experienced a slight decline in volume range or in volume output from film, but not as a result of wear. The decline is the result of oil stains, and stains resulting from cleaning. Many of the cleaning processes are merely smearing processes.

I hesitate to express a definite opinion regarding the desirable volume range of the future. The desirable volume range will depend upon the theatre's carrying capacity. Mr. Mueller pointed out that Warner's are at the moment limiting their volume range to meet the conditions in the field. Our activity at Paramount has been one of pushing the theatres a little, with the hope of bringing more theatres into line so that they can reproduce sound to better advantage and put on a better show.

MR. FRIEDL: It seems significant that the average dialog level was tabulated at +65, which is the reference reading on the noise-meter or the measuring instrument, as acoustic energy in the auditorium. I believe the author also said they could not raise the average level of dialog.

Dialog vs. Sound Effects

Let us assume that modern theatre equipment provides adequate capacity and power for that average dialog range. We are still limited in the volume range of dialog by the noise coming up to meet it. The increase in power will, perhaps, lend more dramatic effect to the music. But what about the dialog? We can not have average dialog at a shouting level; it has to be convincing.

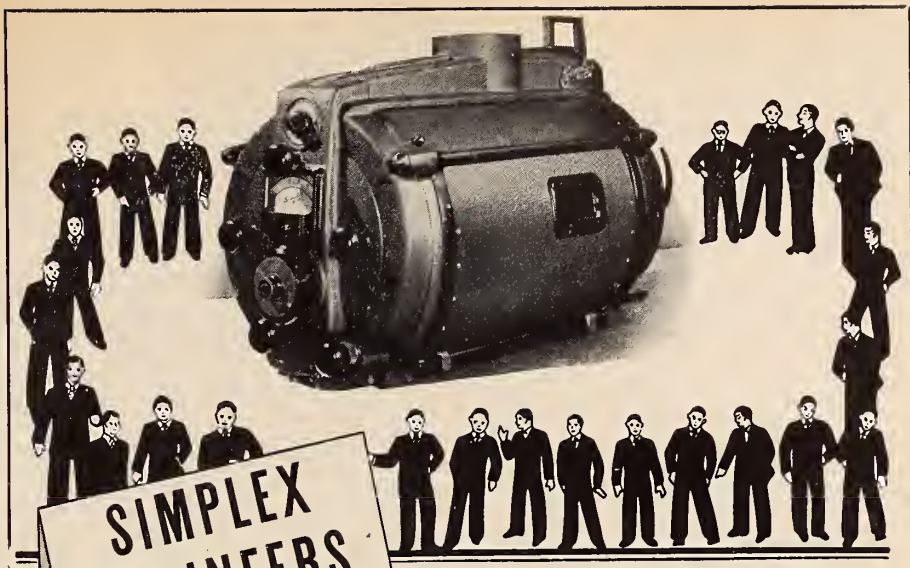
MR. RYDER: In the *Spawn of the North* we had important dialog occurring during the crashing of icebergs and other loud-effects parts of the picture. In certain theatres one would hardly know there was any dialog because the effects so overloaded the equipment. In other theatres the dialog was distinctly heard and understood by the audience, carrying real meaning and adding dramatic value to the story.

There is reason for having power beyond what is required for normal dialog reproduction. In general, I agree that dialog should not be pushed to levels where it is no longer real or convincing to the audience, although at times we have probably offended, along with others, in that regard.

MR. OFFENHAUSER: Where do you place a measuring microphone in a case like this; and what sort of microphone do you use?

MR. MUELLER: The microphone was placed in the center right and left sections of the seats in the main floor of the theatre or in the balcony. A series of measurements was taken with the microphone one-fourth of the way back from the front seats and also at a position three-fourths of the way back. The measurements given are averages of six positions in the case of a stadium type theatre or twelve positions if the theatre had a balcony. A crystal microphone is used.

MR. FRIEDL: In the data presented the dialog and music, as measured in the same



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units, were run at about the same level, that is, in both the theatre and review room. I think I recall seeing +74 as the level. Can you operate at as high an output level in the small room as in the theatre?

MR. RYDER: The output level from the horn—no; the actual level to the listener—yes; even higher in small review rooms, before it becomes objectionable.

MR. FRIEDL: You are not overriding audience noise there, because the noise of the room is less. There were no measurements of an audience in the small review room. There *must* be an audience, of course, but it is negligible in terms of numbers, for noise.

Mr. Mueller points out that in trying to take advantage of all the new fine-grained emulsions, and the low noise of the amplifier systems, as these factors contribute to extending the volume range, we find that the limiting factor seems to be the audience noise; we have to do something to quiet the audience—perhaps by putting carpet underneath the seats, or something like that. Evidently merely increasing the power output will not accomplish the desired result.

Effect of Acoustic Treatment

MR. RYDER: We have encountered still a different factor in suppressing noise by acoustic treatment. The Arlington Theatre in Santa Barbara was recently treated, at a cost of about $16,000, and has since not been desirable for previews. The deadening of the house has created an unfavorable situation.

Although it is not completely dead, it is so dead that the audience does not react normally. People begin to laugh and are stifled; they do not get the reinforcement of the complete audience. As a result, the audience does not laugh as much as they normally would, and they lose part of the enjoyment of the show. It is our feeling that group laughter contributes to the pleasure and enjoyment of motion picture entertainment.

The pleasure of the audience is what we are after, and while my reaction follows the reaction of our production group, we may all be in error. They have a very definite reaction against any house in which the audience does not feel free to laugh. It is surprising how a dead room tends to prevent laughter. Our thought in this regard has been substantiated by the preview cards which we receive from the various theatres.

MR. KELLOGG: Mr. Ryder has brought out a very interesting point about the stifling effect of too much sound absorption on audience reaction. It seems clear to me, now that he has mentioned it, that the expedient I proposed for reducing audience noise could do much more harm than good.

Effect of Average Daily Noise

MR. MCNABB: There is a great difference among people with regard to the level at which they like to listen to music or dialog. For instance, a man who works in a noisy factory will, when he returns home at night, adjust his radio to a level much higher than his wife would like to listen to, because she is used to the quietness of the home.

If the majority of theatregoers live in noisy cities, we must adjust to a higher level to satisfy them. If the majority of listeners are people who live in quiet surroundings, it means that we should have a lower level.

MR. RYDER: There is a difference between audiences in that regard. A tired audience such as is encountered in an industrial section such as Whittier or southeast Los Angeles will react differently than a Beverly Hills, Westwood, or Pasadena audience. Apparently it takes more volume for a tired audience.

Nerve strain is another thing that affects hearing, a fact that has been recognized for some time. A director or producer going to a preview is always under a strain, which frequently affects his hearing.

MR. MCNABB: Loud entrance music automatically raises the level to which people want to listen, and is usually too loud. If the entrance music level were kept low, it would tend to keep the audience quieter.

Main & End Title Volume

MR. RYDER: There is a great deal of controversy in Hollywood as to the proper volume for main and end titles. It is somewhat like the newsreel problem, where each is trying to outdo the other, with no thought of getting into direct competition.

MR. BATSEL: Mr. Mueller's point, I believe, was that compression aids intelligibility in the presence of noise. That has been confirmed by experience in the use of announcing systems in industrial establishments and other places where there is noise to contend with.

MR. SEELEY: A person seems to be more annoyed by a noise that he does not quite know, or the presence of which he is not sure, as well as the fact that the noise may not be justified. For instance, a person walking down the aisle is not quite so annoying as one who is opening a box of candy in the next seat. Those factors I think should be considered.

MR. RYDER: That ties in with the thought that the tests made here were monaural as compared with binoral listening. All our sound, including disturbing noises, comes from the screen, a point-source. If the audience is listening to sound from that source (the screen) and disturbing sounds also come from there, the disturbing sounds are much more objectionable than if they are introduced off to the side, where the audience can discriminate against them.

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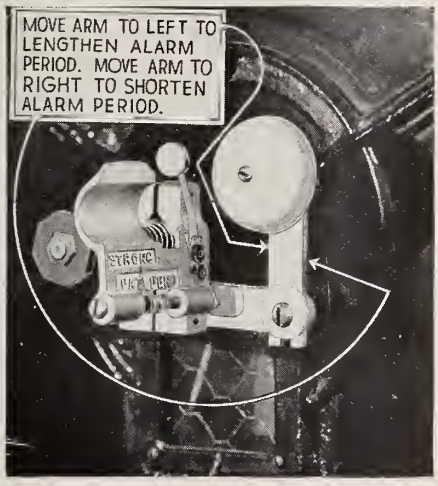
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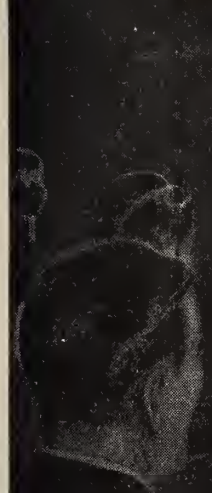


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Monthly Chat

THE rapidly growing use of 16 mm. projection equipment in taverns and outdoor gardens has diverted the attention of the craft from the widespread gains scored by sub-standard units in the small-theatre and itinerant show field. While the organized craft as a whole is cognizant of the importance of these units to the economic welfare of its members, I. P. continues to hear criticism of the results attained with 16 mm. units by projectionists who can handle extremely well any 35 mm. setup.

Next time you get close to a 16 mm. equipment spend a few minutes to dig into it and obtain the low-down.

• • •

Following the first flurry of excitement attendant upon the introduction of the new coated *f*/2 lenses is a development wherein war orders preclude the possibility of the optical people delivering any great quantity of such optics in the near future. Which is bad news, indeed.

• • •

National Carbon Co. reports that more than 60 per cent of all theatres in the U. S. still are using low-intensity arc lamps. This is a sad commentary on the amount of drum-beating done by projectionists in behalf of the modern arcs, and a still sadder reflection upon the merchandising ability of the supply field, everybody included.

• • •

All this gab about three-dimensional sound leave us cold in the face of the fact that hardly a projection room report that we have conned in various supervisors' offices of late doesn't bear the notations "oily" and dirty," "scratched," and "faulty splices". Another illustration of watering the leaves and neglecting the roots.

• • •

Wonder if the recently negotiated sound-film recording contracts contain the same restrictive clauses anent television use as did the first inkings? If the answer be yes, it would leave the film biz right out on a limb.

• • •

The insistence of the S.M.P.E. upon two exits from a projection room, which has won the approval of national regulatory bodies, is already being sniped at by the exhibitor papers. Of course, they mask these attacks on adequate personnel protection by stating that their proposals are intended to be "minima". The NRA Code in 1933 taught all projectionists how easily "minima" tend to become "maxima". No; thanks.

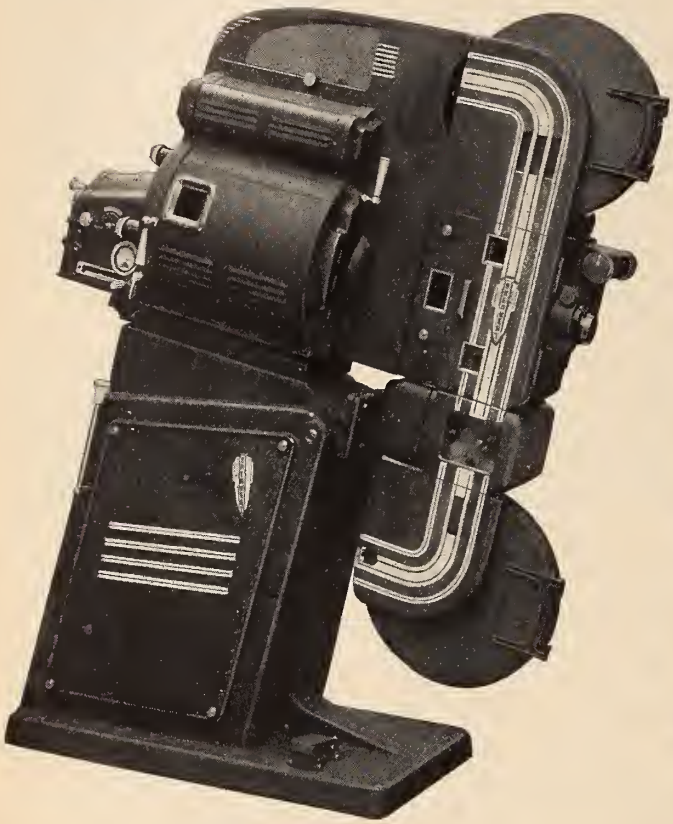
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Precision engineered and precision built for precision performance by men who have specialized in the manufacture of correct theatre projection equipment for the past twenty-nine years—the BRENKERT "80" PROJECTOR therefore has many important features heretofore unheard of.

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INTERNATIONAL PROJECTIONIST

VOLUME XV SEPTEMBER 1940 NUMBER 9

The Caesium Gas-Filled Phototube

By *PAUL P. MELROY*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING COMPANY, INC.

A COMPLETE understanding of the functioning of all units in a sound-projection equipment means better operation, better performance, and a better show. A greater personal satisfaction and a bigger thrill are experienced by projectionists in operating this apparatus, if mysteries are given no place in the projection room. A knowledge only of how to operate a system does not suffice and should be supplemented by knowing "what makes it tick."

Ever since the first sound film reproducer was devised, much has been published regarding the main units which make up a complete system, such as soundheads, amplifiers, loudspeakers, and power supplies, because of the continual progressive design changes which have been made in the characteristics and external appearance of these units.

However, there is one extremely interesting little device that has remained essentially the same throughout these years—that is the light sensitive cell, usually termed the phototube—the veritable heart of the system. Original development and design work on the caesium tube with gas amplification has proven so satisfactory for film sound reproduction that nothing superior to it has been developed in the intervening years.

What goes on inside this device to convert the flickering light of the scanning system into an electric current? This is a subject on which volumes might be written, if all facts, including those relating to early important experiments, were collected for review. However, if this discussion is confined to the bare essentials necessary to describe its internal working, it should be both useful and interesting.

A non-technical definition of a phototube would probably infer that it is a tube which changes light variations into electrical impulses. That would be correct for sound-film reproducer applications, and would constitute as general a statement as could be conceived for a comprehensive definition. However, a more basic definition would be to say that a phototube is a device in which electron emission is produced by the illumination of an electrode. The difference between these definitions is that the former considers the final effect, while the latter gets at the cause.

● Types of P.-E. Devices

The internal working of photo-electric devices, in general, can be classified under three different groups: (1) photo-emission (2) photo-conduction and (3) photo-barrier or photo-voltaic —all depending for their action on radiant energy. Inasmuch as the sound-picture phototube comes under the first group in which electrons are emitted from the cathode and collected upon the anode, the different reaction of the other two groups will be but briefly mentioned.

The photo-conduction second group depends upon the internal resistance of the device varying in accordance with illumination changes, such as the selenium cell; the photo-barrier or photo-voltaic third group generates an internal voltage proportional to the amount of light impressed on either an electrode or its electrolytic medium, such as in exposure meters.

As light-sensitive devices depend on radiant energy for their operation, a clear understanding of the fundamentals and sources of radiant energy is essential. Energy associated with electromagnetic oscillations travelling through space is radiant energy. The frequencies of such oscillations extend over an almost unbelievable range: from the lowest frequency of alternating current up through the radio frequency spectrum, light spectrum, X-rays, gamma rays, to the cosmic rays with a frequency as high as ten thousand billion cycles per second.

Of particular interest is the fact that the only part of this vast spectrum visible to the human eye is a tiny band of frequencies near 750 thousand billion cycles per second. This small band of visible light rays includes red, orange, yellow, green, blue, and violet colors in their respective frequency order and make up the useful range of radiant energy to which the more

common commercial types of light sensitive tubes are confined.

Consideration should first be given to the photo-sensitive surface, within the Phototube, which emits electrons when it is exposed to light.

Following the early discovery that electrons were emitted from certain materials when exposed to light, a series of painstaking experiments revealed that various elements including sodium, potassium, caesium, barium, and calcium, had different response and spectral characteristics. It was found that alkali metals emitted the greatest number of electrons with visible light, whereas a copper-oxide surface would respond mainly to ultraviolet light.

Still further investigation revealed that maximum emission resulted from an extremely thin layer of the sensitive substance. Development for sound pictures led to the general commercial use of a relatively non-photo-sensitive metal for a cathode base, upon which a first thin layer of caesium oxide is followed by a second thinner coating of pure caesium.

● Vacuum or Gas-Filled

Early developmental experiments were made chiefly with phototubes in which air had been removed from the interior of the glass envelope. Such vacuum types, still in commercial use for light-measuring devices, depend fully on the electrons emitted from the cathode surface to produce a relatively small current for a given amount of light. Higher sensitivity, in which greater current would result with the same light intensity, was desired. The introduction of certain gases into the vacuum tube produced this desired greater effective sensitivity because of a so-called "gas amplification" of the primary photo-electric emission.

This production of a greater electron flow may be described briefly as follows. Electrons shoot out from the caesium surface on the cathode and pass to the positive anode. While moving with high velocity through the intervening space, they collide with the gas atoms which break into negative electrons and positive ions.

These additional electrons and ions serve two important duties. The negative electrons are attracted directly to the anode, supplementing the original primary electron flow. The positive ions are attracted to the cathode in the reverse direction and may strike the cathode with sufficient force to dislodge additional negative electrons from its surface, which again supplement the primary electron flow.

Consequently, the total current through a gas-filled tube may be much greater than through a vacuum tube with identical light excitation and polarizing voltage. Fig. 1 illustrates this phenomenon.

The kind of gas used must be restricted to an inert gas, so that no chemical reaction takes place with elements within the tube. There are five commonly used inactive gases, namely, argon, helium, krypton, neon, and xenon. Argon has become universally employed in phototubes because of its relative abundance. Although its heavy atomic weight introduces some sluggish action in frequencies above audibility, it has a distinct advantage in its very low ionization potential.

● Polarizing Voltage

The question now arises, why is a polarizing voltage necessary? This voltage is commonly referred to as the excitation voltage, but the word "excitation" should be strictly associated with the light impressed on a cell, since light is the radiant energy which excites the photo-sensitive cathode into emitting electrons. Some of these electrons, even without a polarizing voltage, would eventually find their way to the opposite electrode. This accounts for the fact that low sound is obtained from a film sound

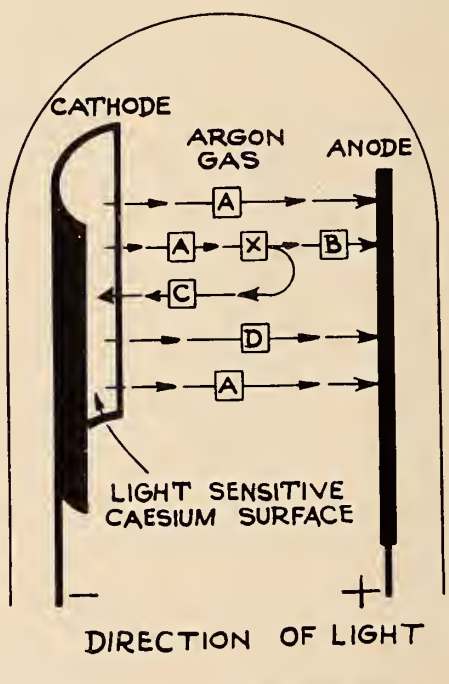


FIGURE 1

Gas amplification of p.e. emission. A—Primary negative electrons. B—Complimentary negative electrons from gas atoms, "X". C-Positive ions from gas atoms, "X". D—Complimentary negative electrons dislodged from cathode by "C". X—Gas atoms struck by electrons "A"

reproducer even when the polarizing voltage has been removed.

But, when an external voltage is applied so that the anode is positive with respect to the cathode, an electrostatic field is established in which the liberated negative electrons are accelerated and directly attracted by the positive anode. This increased speed causes greater impact against the gas atoms and creates more ionic activity, as previously described.

At very low voltages, the current flow for a certain light intensity is practically the same for both vacuum and gas-filled tubes. As the voltage is increased, the vacuum tube current increase is relatively small, but the gas-filled tube current increases rapidly due to the formation of new electrons and ions until a point is reached where the positive ions returning to the cathode release so many extra electrons as to produce uncontrolled regeneration. Then, the gas breaks down into a visible blue glow which may continue even after the exciting light is removed.

If such a high polarizing voltage remains impressed on the tube, it will be seriously damaged through disintegration of the cathode surface with a consequent drop in electron emission and therefore sensitivity.

Phototube for use with light in the visible spectrum have envelopes made from ordinary soft lime glass. Lead glass is excluded because of its apparent chemical reaction with alkalis. Where measurements of ultra-violet light are necessary, the envelope must be made of quartz or special glasses capable of passing the higher light frequencies.

● Photo-Electric Laws

With the preceding analysis of the nature of radiant energy, photo-emission, gas and polarizing voltage, a better understanding and appreciation of the fundamental laws of phototube action should result. Of particular interest are the following:

(1). The number of electrons simultaneously emitted from a photo-electric surface is proportional to the intensity of the incident light.

(2). Excluding the effects of a polarizing voltage, the velocity of electrons leaving the photo-electric surface is proportional to the color of the incident light, and is not affected by the intensity of the light.

A typical and widely used phototube for all types of film sound reproducers is the RCA Type 868. the basic principles of which have already been discussed in a somewhat general manner. When closely examined, its cathode

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PLUS-X
for general studio use

SUPER-XX
when little light is available

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for backgrounds and general exterior work

EASTMAN NEGATIVE FILMS

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Droll Process Carbons sell themselves—on sight. Agents need only demonstrate the carbons once—we'll do the rest. Representatives will be selected on the basis of standing in the craft and familiarity with territory. No investment required. First come—first served. Wire, write or 'phone us.

†U. S. Patent 2,120,243.

DROLL THEATRE SUPPLY CO.

GUS ANDERS, MANAGER

351 East Ohio St. Chicago, Ill.



FIGURE 2

and anode may be noted in full view. Referring to Fig. 2, the cathode is the larger semi-cylindrical plate made of silver, first coated with caesium oxide over which is a final thin layer of caesium. The cathode emits electrons which are collected by the anode, the small vertical rod in the center.

A small glass insulator is at the top to act as a support to prevent vibration. The mechanical vibration, sometimes found in projectors, might otherwise shake these two elements and produce microphonic noises in the sound. Connections to the base of these elements pass out to the base prongs of the tube, only two of which are used as contacts.

The metal capsule, suspended from the anode, originally contained the caesium compound pellet which in manufacturing was decomposed by heat, after the air had been removed from the tube. When the pellet was decomposed, the caesium was discharged and spread over the oxidized silver cathode. The slight purple tint of the glass directly in front of the cathode was caused by the chemical reaction between caesium and glass.

On the back of the cathode may be seen a brown painted-like strip which is a compound to absorb excessive caesium discharged from the pellet. Argon gas is introduced into the vacuum tube at a pressure of approximately 100 microns—roughly, one ten thousandth of atmospheric pressure.

Among the more interesting characteristics of the RCA 868 is its sensitivity to red light, as shown in Fig. 3. The incandescent tungsten filament lamp, commonly used as the exciter lamp, radiates light energy very rich in red and infra-red rays, to which the RCA 868 has maximum response. This makes its use doubly effective and efficient for sound-film duty.

When the phototube is inserted in its socket in the soundhead, application of rated polarizing voltage is automatic from a power supply unit in the system. Light from the exciter lamp passes through the optical system and finally strikes the cathode of the phototube. With no film in the soundhead, the total light on the cathode is approximately 0.1 lumen. This light excitation causes an electron flow through the closed external circuit, which includes the polarizing voltage source, protective resistor, primary of the transformer and phototube, as illustrated in Fig. 4. The current flowing through all these units in series is very small, possibly 4 microamperes (4 millionths of an ampere). This is a steady direct current and will remain the same amount as long as the light intensity striking the tube is not changed.

If the light be reduced, the electron flow is decreased and a corresponding drop takes place in the current through the external circuit. Thus, the current through the primary of the transformer varies in exact accordance with the light intensity on the cathode. If the light is interrupted 1000 times a second, a frequency of 1000 cycles per second will originate in the phototube transformer and be passed on through the amplifier to the loudspeakers, where a 1000-cycle note will be heard.

When film is threaded through the projector and soundhead so that the focused light beam passes directly through the sound track, the width of the black emulsion on the track (variable area) or the degree of blackness of the emulsion on the track (variable density) determines the amount of light which finally strikes the phototube cathode. When the film is in motion at the proper speed, the light is varied in exact accordance with the recorded frequency on the film.

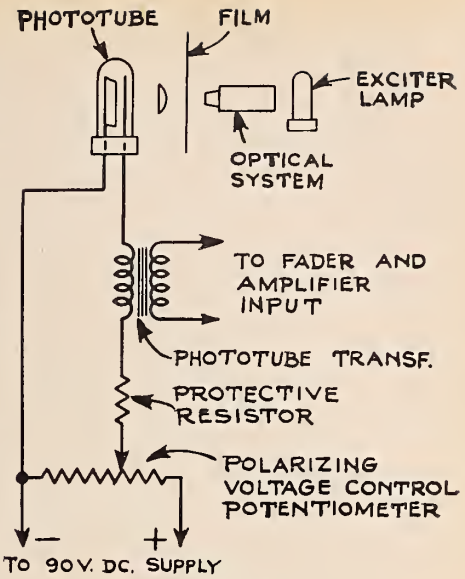


FIGURE 4

Typical phototube circuit for sound-film reproduction

Two important facts should be noted:

(1). The frequency or pitch of the sound depends only on the number of times per second that the light is interrupted.

(2). The loudness or level of the sound depends on the amount the light

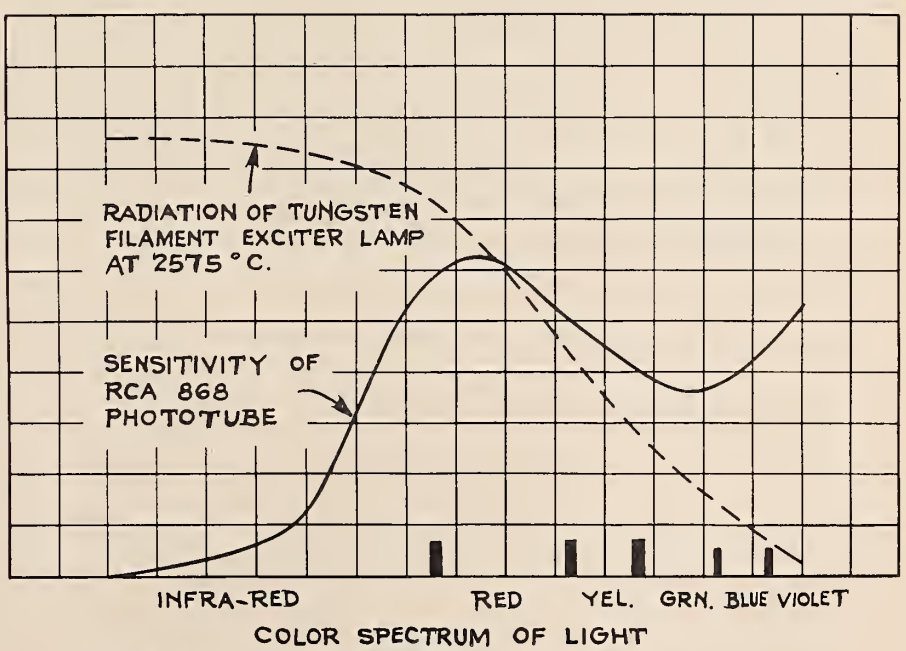


FIGURE 3. *Spectral characteristics of phototube and exciter lamp.*

is changed or varied; a change from full light to complete darkness, at an audible rate, causes the greatest swing of phototube current and consequently the greatest sound volume.

● Care of Phototubes

Little forethought is required in guarding against the exposure of phototubes to injurious hazards, if a few simple facts are observed.

The polarizing voltage should not be increased beyond its specified limit.

Any series protective resistor should not be decreased in value or shorted in the voltage supply circuit.

Strong light from external sources, such as arc light or portable trouble shooting lamp, should not be permitted to strike the phototube in the sound-head.

Spare phototubes, not in use, should be well covered against exposure to light.

Although the average sound-projection phototube is a rugged device capable of withstanding considerable abuse, observance of these precautions will assist in preserving its high sensitivity with a long useful life.

Sound Recording, Television Topics Feature SMPE Hollywood Program

SOUND recording and television topics will be accorded the major portion of attention at the forthcoming Fall Convention of the Society of Motion Picture Engineers in Hollywood, Calif., Oct. 21-25. Advance registrations indicate that this meeting will be one of the best attended of the Coast series, which are designed to afford the Society membership an opportunity to become better acquainted with studio technicians and production problems.

Headquarters will be the Hollywood Roosevelt Hotel, where excellent accommodations are assured. A reception suite will be provided for the Ladies' Committee, and an excellent program of entertainment will be arranged for the ladies who attend the Convention.

Room reservation cards were mailed to the membership early in September, and should be returned to the Hotel immediately to be assured of satisfactory accommodations. Indoor and outdoor garage facilities adjacent to the Hotel will be available to those who motor to the Convention. Members and guests will be expected to register immediately upon arriving at the Hotel. Convention badges and identification cards will be required for admittance to the various sessions, studios, and several motion picture theatres. The following table lists the railroad fares and Pullman charges:

City	*Railroad Fare (round trip)*	*Pullman (one way)*
Washington	$132.20	$22.35
Chicago	90.30	16.55
Boston	135.00	23.65
Detroit	106.75	19.20
New York	135.00	22.85
Rochester	124.05	20.50
Cleveland	111.00	19.20
Philadelphia	135.00	22.35
Pittsburgh	117.40	19.70

Arrangements may be made with the railroads to take different routes going and coming, if so desired, but once the choice is made it must be adhered to, as changes in the itinerary may be effected only with considerable difficulty and formality. Delegates should consult their local passenger agents as to schedules, rates, and stop-over priviliges.

● New Equipment Exhibit

Technical sessions will be held in the Blossom Room of the Roosevelt Hotel, with several evening sessions scheduled to accommodate those whose work precludes daytime attendance. An exhibit of newly developed equipment will be a feature of the meeting. Those who wish to enter their equipment in this exhibit should communicate immediately with the Society at the Hotel Pennsylvania, New York.

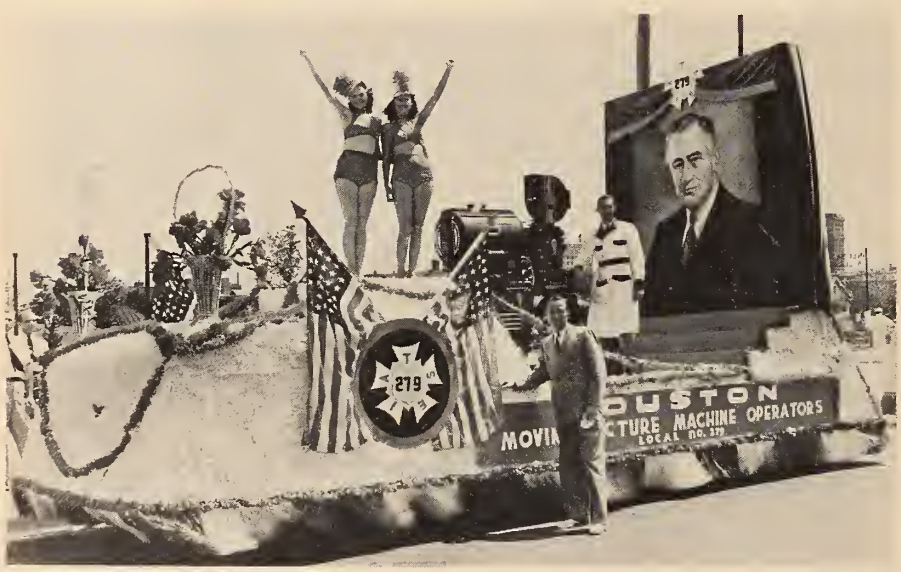
The semi-annual banquet will be held on Wednesday, the 23rd. Annual presentations of the Progress Medal and the Journal Award will be made. Officers-elect for 1941 will be announced and introduced, and brief addresses will be delivered by prominent members of the industry.

Numerous interesting side trips may be made to various points throughout the West, both by railroad and bus. Among the bus trips available are those to Santa Barbara, Death Valley, Agua Caliente, Laguna, Pasadena, and Palm Springs, and special tours may be made throughout the Hollywood area.

Those who wish to visit San Francisco may arrange for stop-over privileges when purchasing their railroad tickets. Arrangements have been made

(Continued on page 21)

Local 279 Float Sensation of Houston Labor Parade



ABOVE is a reproduction of the sensation of the Houston, Tex., Labor Day parade—the adroit combining of beauty and utility by the rascals of Local 279 who schemed far in advance to show up every other entry. Valuable oil painting of F. D. R. was insured for $3000 during parade period. The equipment included Brenkert lamp and projector (courtesy Southwestern Theatre Supply), with Nelson aluminum magazines, plus a wow p. a. system loaned and set up by L. W. (Cotton) Merchant, a projection mug.

P. A. system fed the outgiving of the Kate Smith record "God Bless America" through hidden loudspeakers. Equipment attended by Ken Christiansen, another projection mug, who was adorned in a white smock trimmed with blue (get that!) with orange I.A.T.S.E. letters across the back. The chief conspirator was one Frank Coogler, who designed and was in complete charge of the float, with an assist by Int. Rep. Eddie Miller.

What's that? The gals? Oh, they are the Misses Dot Bradley and Ruby Simmons; but this news won't be of any benefit, because they're not playing in Houston now.

For this contribution thanks to Clarence Nelson, of Local 279, who makes those bee-oti-ful Nelson aluminum magazines and other projection equipment.

Periodic Inspection Protects the L. U., the Crew, and Sells Service

By *JAMES J. FINN*

FROM time to time there have appeared in these pages expressions of strong support for a plan entailing Local Union adoption of periodic inspection of projection rooms and their content, particularly the projector head, and insistence upon pre-show inspection of all film, the results of which were to be spread upon a form in triplicate, with one copy going to the exhibitor, one to the exchange and one being kept on file in the projection room.

Such a plan has two aims: (1) as a safety measure pertaining to projection room personnel, (2) as protection for the Union against unwarranted billing for damaged film, and (3) as a service to the exhibitor and a means of binding him closer to the Union.

Most important, of course, is No. 1; but No. 2 has been and still is fraught with serious consequences to the various units of the organized craft. Apropos No. 3, Mr. Exhibitor may or may not relish the implied hint anent defective equipment or room inadequacies, but his attitude would detract not one whit from the "service" aspect of the plan.

● Detroit L. U. 199 Plan

This writer has long held the notion that the majority of Local Unions were very delinquent relative to the matters involved in the aforementioned plan, and on numerous occasions rather harsh words were spread on these pages to point up this delinquency. Recently this writer has been taken over the jumps by several Local Unions which either long ago or recently have adopted just such a plan. The purpose of this article is to disseminate information anent the actual working of such a plan in the hope that many more, if not all, Local Unions will subscribe thereto.

Sometime ago we visited with Roger Kennedy, b. a. of Detroit Projectionist Local 199 (and an I. A. vice-president) and chinned with him about projection room fires, defective equipment, exchange bills for damaged prints, and other angles of protection for both the room crew and the Local Union. Roger agreed that the problem was acute, but that it didn't occasion any trouble for Local 199. In answer to our surprise "Why not"? Roger emulated Al Smith by having a look at the records of his organization. The story told by these records, plus Roger's verbal embellishments, goes something like this:

Local 199 has a duly appointed Projection Room Inspection Committee which *every six months* (not annually, mind you) visits every projection room within its jurisdiction. First, careful attention is paid to, and notes thereon duly recorded, the physical aspects of the room itself—exits, placement of equipment, general orderliness, *etc.* Then follows a minute inspection of every piece of equipment in the room, from the projector head right down to the wiping cloths. The findings of this inspection are recorded and turned into the Local.

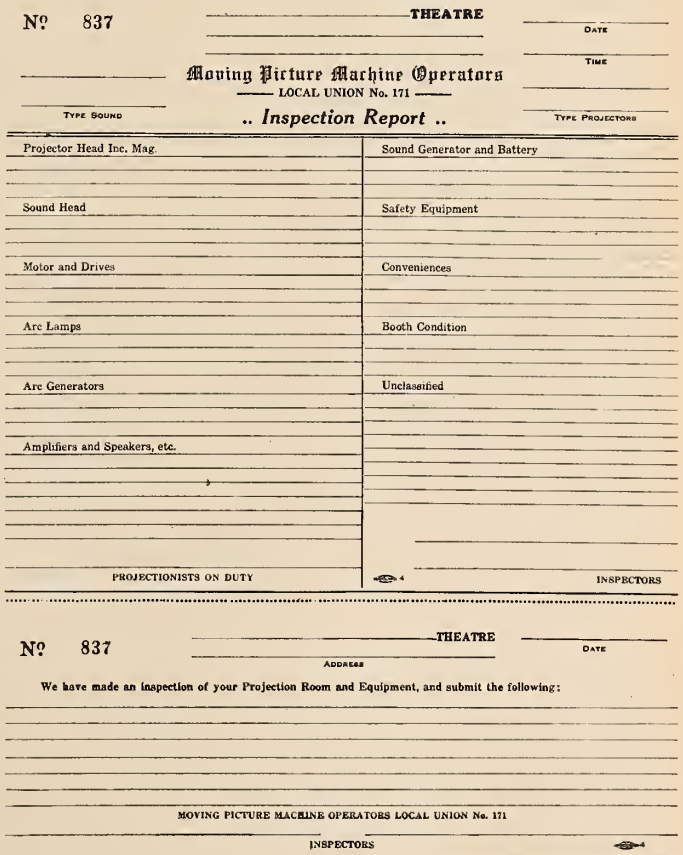
After careful examination of these reports, if any deficiency in the physical aspects of either the room itself or its content is apparent, the exhibitor concerned is notified by means of a courteous but firmly-worded letter that such-and-such condition exists in his projection room, and won't he please set about correcting the deficiency at the earliest possible moment. Take particular note that the exhibitor receives a *written* notice, as a means for protecting the Local in any eventuality.

Should a particular report reflect discredit upon the projection crew, such as disorderliness, immediate notice is issued by the Local to the crew to put things in order forthwith.

Simple? Certainly. Effective? Positively. Easy of accomplishment not only in Detroit but by every Local Union? A cinch.

Passing the buck to Local 199 on the score of injury to any projectionist, or film damage, or even an un-

Form used by Pittsburgh Local 171 for annual inspection of every projection room in its jurisdiction. Note inclusiveness of form, made in triplicate, one for L. U., one for exhibitor, and one for room crew. Projector head is accorded major attention. Service is free, of course



No. 837 ——— THEATRE ——— DATE

TIME

Moving Picture Machine Operators
LOCAL UNION No. 171
.. Inspection Report ..

TYPE SOUND ——— TYPE PROJECTORS

Projector Head Inc. Mag.	Sound Generator and Battery
Sound Head	Safety Equipment
Motor and Drives	Conveniences
Arc Lamps	Booth Condition
Arc Generators	Unclassified
Amplifiers and Speakers, etc.	
PROJECTIONISTS ON DUTY	INSPECTORS

No. 837 ——— THEATRE ——— DATE

ADDRESS

We have made an inspection of your Projection Room and Equipment, and submit the following:

MOVING PICTURE MACHINE OPERATORS LOCAL UNION No. 171

INSPECTORS

satisfactory presentation of the show requires more than a mere accusation of blame in the face of the Local's own records compiled by its Inspection Committee. Local 199 is *insured* against any and all unjust claims, the only premium paid being an intelligent appreciation of the realistic aspects of the relationship between projectionists, their exhibitor clients, and the film exchanges.

● L. U. 171 Inspection Routine

His news-sense having been titillated by our findings in Detroit, this writer decided to do a little scouting on other projection fronts.

Sure enough, a similar plan was revealed to be operating smoothly in the jurisdiction of Pittsburgh Projectionist Local 171. Here the Local Union directs an annual inspection of every projection room manned by its members. So much did this writer like the Inspection Report utilized in this work that he snitched one for reproduction along with this article. Reference to this form tells the story of how the Inspection Committee proceeds. A special feature of this work is that *improvements* are given special mention in the report.

This form, in triplicate, provides a copy for the exhibitor, one for the Local Union files, and a copy for the projection room. Where room or equipment defects, or both, are noted, the form is sent to Mr. Exhibitor along with a letter directing his attention thereto and requesting that corrective measures be applied. Local 171 impresses upon its exhibitor friends that such inspections are not a form of criticism but rather a reflection of the desire of the Local to "Sell Service" *at no cost* to its clients.

Even the large circuit projection rooms, usually supervised from New York, do not escape the watchful attention of Local 171. Recently a check on an exchange screening room revealed several equipment defects, the nature of which was transmitted to New York along with a request for corrective action. The supervisor so addressed replied immediately, thanking the Local for its information and promising prompt action.

On the score of constant checking on the condition of film as received from the exchanges, the form utilized by Charley Dentlebeck, supervisor of projection for Famous Players Canadian Corp. theatres, is of special interest. This form (see accompanying reproduction) includes 17 divisions wherein the exact condition of every reel of film received from exchanges can be noted, including the sound track and with special attention being accorded sprocket holes.

This is inspection with a reverse twist apropos the aforementioned procedure in that here the theatre itself is able to call the exchanges to order and cite specific defects. One important beneficial result of these Dentlebeck forms is the practical elimination of all punch marks and the destroying of leaders and tailpieces, because the report from one theatre will show up the guilty party whether it be an exchange or a projectionist on a prior run. Any shortcoming can be traced to the proper source.

● Worth General Adoption

This, then, is conclusive proof of what can be accomplished with little trouble by any projectionist group that has the welfare of its members and of the organization at heart—not to mention the angle of "selling service" to its exhibitor clients. This, then, is the way to eliminate more than 95 per cent of the current interminable Local Union-exhibitor-exchange wrangling anent responsibility for personal injury or damaged prints. And where responsibility can be established definitely and accurately, as it can with the help of such a routine, there can be laid the basis for corrective action.

I. P. considers this matter of such importance as to warrant the circulation shortly of a survey form among every unit of the organized craft, the product of which should go far toward improving projection technique and at the same time improving relations between all industry branches concerned. To this end co-operation of all Local Unions is solicited.

FORM T-24 REV. 6-38 — Supervising Projectionist's Copy

SOUND AND PROJECTION DEPARTMENTS

FILM INSPECTION REPORT

THEATRE [redacted] CITY [redacted] DATE April 26/40

TITLE	NO. OF REELS	PRODUCER	RECEIVED FROM	SOUND TRACK: SPROCKET MARKED	SOUND TRACK: OILY	SOUND TRACK: SCRATCHED	CONDITION OF FILM: BRITTLE	OILY	DIRTY	SCRATCHED	SPROCKET MARKED	BAD PATCHES	MISFRAMES	PUNCH MARKS	SCRATCH MARKS	FOOTAGE MISSING	EDGE BROKEN	SPROCKET HOLES: STRAINED	BROKEN	STRIPPED
"Free, Blonde & 21"	3 L. 1s.	Fox	Fox					X												
Fox News no 65	1	"	"																	
"Sidewalks of London"	4 L. 1s.	Paramount						X		X		X						X		
Vigil in the Night	TRAL.	R.K.O.	R.K.O.																	
Millionair Playboy	"	"	"							X										

NOTE—The above check sheet is merely a guide for reporting condition of film when received. The inspection must be carried out on all film before each change in performance. Defects in film affecting Projection, Sound Reproduction or introduction of fire hazards should be detailed in space provided below. Serious defects should be reported to film exchanges by telegram without delay and this fact noted on this form.

REMARKS: "Free, Blonde & 21" Oily on starts & little on edges three reels. Reel #3 sprocket holes strained on one side, from startmark(s) to picture.

"Sidewalks of London" Oily on starts, Reel #4 sprocket holes strained on one side, about 25 ft. on start

THIS FORM MUST BE COMPLETED IN RESPECT OF EACH PROGRAM CHANGE AND MUST BE POST MARKED AS MAILED TO HOME OFFICE THE DAY EACH SHOW OPENS.

Inspected by H. F. Usher.

and Manager A. E. Brown

Projection room report used by Famous Players Canadian Corp., each show being checked through to supervisor. Note the 17 divisions at right of form, providing for accurate reporting. Such a form, while in this case a circuit procedure, should prove of great value to any Local Union. Note references to prevalence of oil on prints

Defects in Motion Picture Projection and Their Correction†

By *IRL GORDON*

FORUM THEATRE, AKRON, OHIO

The defects in projection caused by oil and dirt on the film are discussed at considerable length, with respect to the appearance of the screen images of the following groups of prints: (1) toned print; (2) light or high key prints; (3) color-film; (4) very dark prints. The seriousness of the defects caused by oil in the four groups is in this order.

The causes of oil in film are discussed in detail, and suggestions are made for alleviating this situation.

CONTROL of the flicker evil has had much attention from the industry. Flicker caused by shutters, light fluctuation, and uneven photography has been investigated, and progress has been made on the elimination of each. But today there still exists an evil which has been with us since the first release print. It is the evil of oily film, which is becoming more and more noticeable through the adoption of more brilliant light-sources and high-key photography.

It is essential to good projection that the film be clean, since every defect is highly magnified, and any deviation from perfect cleanliness is detrimental. Perhaps the most commonly recognized indication of oily film is the travelling "frame-line effect," so noticeable with the high-key prints. A lighter area, the width of a frame line, starts from the bottom of the screen, and travels slowly to the top. This is surrounded by a darker flickering area superimposed over the entire picture.

● Various Oil Patterns

All oil patterns are not of such a well defined shape. They vary from frame to frame and depend in extent upon the amount of oil on the film at that moment. The pattern changes from one rewinding to another. It always shows on the screen as a crawling, spotty effect which may move from bottom to top as the "frame-line effect," or horizontally as a dancing effect. It may even appear as a wavering mass of flicker. If the film is light or toned, the effect is very pronounced, due to the contrast between the oil spots and unaffected areas.

If oil is present on the film in a thick layer, the image becomes blurred, causing an out-of-focus effect. This type of oily film shows a strong tendency to buckle under heating. The alternate sharpness and blur of the image, combined with "mass flicker effect," are very tiring to the eyes, and with the long show times of double-feature bills, running from three hours upward, sets up a condition described by Snell, namely, "Anything causing difficult seeing will result in eyestrain."

†J. Soc. Mot. Pict. Eng. (June 1940)

The combined action of all the various types of flicker caused by oil spots, constantly changing position over a period of hours, most certainly must affect the eyes of the theatre patron and mar his enjoyment. Almost all films, after the first and second runs, have some oil on their surface.

Various kinds of oil are used for lubricating motion picture projectors. Some are thin and fairly transparent; others are of a heavy, sticky automobile type used under the mistaken impression that they will cling to the bearings longer. When any oil is on the film, dirt, dust, and bits of grit are picked up and lodge along the path of the film in the projector, or cling to the rotary stabilizer drum of the sound-head thus constituting a prolific cause of scratches.

If the emulsion with all this dirt, which acts as an abrasive, happens to "skid" while rewinding, fine scratches occur which soon fill up with dirt and show on the screen as a form of "rain."

● Four Film Groups

Once oil is on the print, it is a difficult job to remove it without proper cleaning machines. The mere wiping of the film with a rag moistened with cleaning fluid will not do much good, since in a very short time the rag becomes so dirty it merely smears the accumulated dirt over a larger area. Very few theatres have installed cleaning machines.

Film images may be classified broadly into four groups accordingly as they show oil spots, as follows:

(1). The first and worst is probably the toned print, and the most seriously affected of this type is the brown toned film. Indeed, if a liberal dose of oil is present, the result is so very annoying that it will detract from the dramatic value of the story in spite of concentration on the part of the observer.

We have had many complaints of "something wrong with the picture," when showing this type of print. "Frame-line effect" and "mass movement of oil" stand out very clearly.

(2). Next is the print in the light or high-key, containing very light scenes, outdoor western shots, and scenes in which there are great areas of low density. "Frame-line" and "mass" effects predominate. Dirt and scratches show plainly. Cartoons are included in this group.

(3). Color-film comes next. With some scenes the oil causes a fuzzy appearance; on the lighter scenes "frame-line" and "mass" effects are very annoying. In only a few instances, however, does the oil appear to change the color values. However, with the trend to lighter color prints the oil evil is becoming more troublesome, because on the dark prints of the past the oil spots did not show up so plainly, as explained hereinafter.

(4). Probably the least affected are very dark prints, in which even the highlights are grayed considerably. These are called "low-key" prints. Oil on this type shows only as a mass effect in the lighter portions of the scene, causing a wavering effect. The tendency for the emulsion to become scratched seems greater, which may be accounted for by the fact that the emulsion appears to be softer when much oil is present. If oil happens to be present in considerable quantity the image seems to change color.

Dense prints are difficult to project in any event, and the addition of oil and dirt further reduces the brilliancy of the screen image. Some tendency to buckle has been experienced with oily dark prints, though this can not be stated as the general rule.

Oil gets on film in various ways. A

new print will begin to show signs of oil along the left side within a short time. With the new print, poor waxing or treatment before showing is one reason why the print is often "directly oiled." A new print as received from the exchange has been either waxed or treated. The first time through the projector everything is fine. After three or four showings, however, trouble very often starts. Usually during the evening show on the opening day the print begins to stick.

Late-model projectors have means for tension release, but tension has to be so loose that the screen image will jump, and rather than face a bill from the exchange for strained perforations or have a jumpy picture, the tension is eased up a little and oil is poured on the perforation track, which in successive runs spreads over increasingly large sections of the film. Quite a number of first-run projectionists have felt obliged to resort to this oiling practice at some time or other.

As to the relative merits of the various film treatments with respect to preventing oil spotting I have no reliable data, but do know that sticking occurs with all of them on occasion.

● Common Contact Points

The most common path of access to the film is through contact of the film with oil in the projector mechanism, particularly near bearings or intermittents, and in sound-heads. Worn bearings, leaks at the intermittent and over-oiling cause oil to be smeared over the interior of projector and sound-heads, often causing pools of oil to be formed.

Gears throw off oil which drains and seeps through crevices, often running down the magazines, to drop either in a pan or directly upon the floor under the lower magazine causing an oily area which collects dirt and dust. In threading, the leaders are dropped on the floor, gathering this oil and dirt.

The first two hundred feet of a film are always oily and dirty, tending to make change-overs noticeable. The oil is carried by the back of the film, sticks to the rotary stabilizer drum in the sound-head, and is distributed over additional areas. As a result of rewinding, the oil and dirt are spread along the film until finally they are present from end to end of the reel.

The eradication of the oil evil will be a difficult task. It requires careful study and cooperation by all concerned: everyone from producer to projectionist, including equipment manufacturers. Such evils lower entertainment values and, in the last analysis, detract from box-office income; hence everyone connected with the industry is affected.

People tire of attending theatres where the screen fare is marred by flicker and the sound reproduction punctuated by pops, cracks, and unevenness caused by oil and accumulated dirt. With each new advance toward a brighter screen image, the defect becomes more visible, and the time to effect eradication of it is right now.

The theatre can do its part by providing the necessary rags, cleaning materials, and working conditions (some projection rooms boast as much as one rag a month). Above all, theatre managements should insist that exchanges supply cleaned prints.

Projectors should be kept in good repair, and a fair amount of supervision should be exercised by the theatre managers to see that the projection room is kept clean. Reports of film conditions should be kept and action taken when necessary, instead of merely filing the report against the time when the exchange might complain about film damage. The cooperation of the projectionist should be sought and encouraged, to get the best possible screen image and sound quality at all times.

I wonder how many exhibitors, if they were in the automobile business, would drive a mud-spattered car before potential customers; yet they permit parading of oil-soaked films before their regular customers expecting them to like the show and come back for more.

The manufacturers of motion picture projectors should investigate ways of eliminating oil seepage, even going so far as to make something foolproof if necessary. Grease-packed bearings, roller or ball bearings, or better sealing of existing bearings might be considered. Due to the excessive projection angles, much over-oiling takes place when it is attempted to keep oil in the top parts of the bearings.

Sound-heads should be drilled to drain any oil that might collect, and some simple oil-catch, flexible enough to fit the older projectors, should be made available. Some of the existing oil-pans and drains will not fit older sound equipment now in use.

By using a lighter color for the projectors the oil and dirt would show up, and through pride the projectionist would be led to keep his equipment cleaner. The black now used does not show the oil and dirt plainly and tends to occasion neglect.

Exchanges should seek better green film treatment and should clean prints after each booking; also schedules should be worked out to stop the circuiting of prints from theatre to theatre with no inspection or cleaning.

Sufficient additional prints should be issued if bookings are heavy. In one instance a print started in a first-run house and was passed on through seven houses before it went back to the exchange. This was regular practice. It was weeks before the print reached the exchange.

Further study should be given the treatment of toned prints, and probably some work done on an oil repellent to coat all films. It has been suggested that toned prints be treated with a solution that would fill up the pores in the surface of the toned film and thus repel the oil to a great extent. So far as my memory goes, I have never received a print treated in this manner.

If oil were of a brilliant color, it would be so noticeable that it would not be long before steps would be taken to deal with the situation; but since it is semi-transparent, its effects are not fully realized. It will take extensive education and vigilance to cope with the evil.

Film goes into all kinds of projection rooms, some dirty, others clean, but by the use of reports, education, and vigilance, it may soon become apparent who are the worst offenders so that steps can be taken to eliminate the source. Only then will the projectionists in the smaller theatres be able to give the patrons excellent projection equal to that in the first-run houses.

RCA Offers Projectors, Screen to Independent Dealers

The Photophone Division of RCA Mfg. Co. has announced plans to market a complete line of Hurley sound motion picture screens through independent theatre supply dealers throughout the U. S. At the same time, Edward C. Cahill, RCA Photophone Manager, announced the development and introduction of a radically new type of "Magic Screen," which provides greater and longer-lasting reflecting properties, and better sound transmission at lower cost.

Some months ago, RCA worked out an agreement with the Brenkert Light Projection Co. whereby the new Brenkert film projectors, lamps and RCA sound reproducing equipment were made available to a group of independent supply dealers. Recently, RCA arranged to make Century film projectors available to these dealers.

All of these moves, RCA states, "are designed to round out the equipment lines being handled by those independent theatre supply dealers who are cooperating with RCA Photophone in the sale of RCA sound equipment."

Presentation Tips on Technicolor Prints

Appended hereto are excerpts from the booklet containing suggestions for proper projection of that screen epic "Gone With the Wind," with particular emphasis upon auditorium lighting requisites therefore. These suggestions, although compiled especially for GWTW runs, are applicable to and should enhance immeasurably the presentation of any Technicolor print. Rating a bow for the preparation of the material, and much other helpful comment contained in the booklet, is the Projection Dept. of Loew's, Inc., directed by Lester B. Isaac.

SINCE the production is made in Technicolor, a minimum amount of light should be used in the auditorium proper. During the continuous performance, where people will move in and out, it will be necessary to have sufficient illumination in order that such movements can be made in safety. It is therefore suggested that the auditorium lighting be of blue. This blue lighting should be of sufficient glow only to insure safety in the movements of patrons.

Plus this blue lighting, the aisle and step lights should be utilized and of course, the exist lights. The latter, where local ordinance permits, should be in green. No reds or ambers, except where the law requires, should be used for lighting of the auditorium in the showing of this production.

Extreme care should be taken that no glaring lights, such as side wall brackets, *etc.*, strike the eye, as this will serve to interfere with the proper color effect of Technicolor. Particular care should be taken where side boxes are in use, that all lights to the entrances of these boxes should be masked, either by the box curtains, or some other method that will prevent the glare of same into the patrons' eyes.

● House Lights, Stage

The beauty of your Technicolor print of GWTW will be greatly damaged if house lights are left lighted during the projection of the film. It has been learned from wide experience and experimentation that *any kind of theatre lights harm Technicolor projection.*

It is requested that especial care should be taken to see that no light, especially colored light, is projected onto the screen, screen masking or stage proscenium prior to, or during the showing of the picture. The color values of GWTW have been achieved with great care and at great expense by a staff of experts, and theatre lighting effects will throw the color values of the picture off balance. Please do not have any screen masking or stage proscenium lights even during the main title, as this also has been designed with great care and at great expense.

In their enthusiasm for GWTW many exhibitors have gone to great length to dress their theatre stage for the showing of the picture. Unfortunately, in some cases the type and placement of the decorations of the proscenium arch only served to draw the audiences' eyes away from the screen. Because of the length of the picture and the fullness of the story any distraction whatsoever will effect your audiences' enjoyment. Therefore, make certain that no light-colored drapes, illuminated clocks, vases of flowers, tinsel or other light reflecting decorations are placed near the screen. The carefully created color harmonies of this Technicolor production require expert showmanship to bring them to the screen in their full beauty.

The mechanisms, sound heads, magazines, and fire valves, should be kept extremely clean at all times. The use of a cloth on all these parts, after each reel, will insure clean projection throughout the engagement and add to the elimination of possible scratching.

This is the latest type of Technicolor and it will be found that an excellent focus can be maintained at all times, providing, of course, that the projection lenses and arc condensers are kept in a clean condition. The faithful reproduction of this picture onto the screen depends upon the diligence of the projectionist and we are confident that they will cooperate to the fullest extent.

It is recommended that at least one week prior to the showing of this picture, that your sound equipment be given a thorough inspection by your service engineer and necessary corrections be made in order that the ultimate in reproduction may be obtained.

It is suggested that the necessary volume for dialog be set in accordance with the requirements of the auditorium. Once the proper dialog volume is set, no other changes will be necessary, as the recording has already provided for changes in volume for sound effects and music. Therefore, when your auditorium dialog is set properly, the effects and music will automatically increase in volume in accordance with the dramatic effects desired by the producer.

Color Television from 16 mm. Film Shown by CBS

Color television in vivid hues was demonstrated to the press recently by the Columbia Broadcasting System, as projected from a 16 mm. color film. Although the test was held over wires in the laboratory, engineers explained that the color equipment had been tested successfully on the air from the CBS transmitter atop the Chrysler tower.

Commercial applications must await further developments, but the engineers see no reason why home television in the future should not be in natural colors.

Marked Color Contrast Noted

The marked contrast between images in black and white and the same scenes in color was revealed by having a standard black-and-white screen alongside a television receiver equipped for color.

As a further advantage of color the contrast was sharp between black and white and colored maps. The lights in the darkened room were turned on and the black-white map lost its clarity, while on the color screen the map remained clear. Spectators remarked on the texture of velvets and other fabrics in color compared to the flat effect of black and white.

No direct pick-ups were attempted. The engineers explained that "immediate television," or live pick-ups, comprise the next step in development, and they hope to demonstrate direct action shots before the year's end. The pictures as reproduced on a nine-inch cathode ray tube measured 5½ by 7¼ inches. Larger colored pictures are possible, according to CBS.

Utilize Filters For Color

In accomplishing the "painting" the colors are not streamed through the air as are sound and pictures. The trick of the three-color process is done by filters, red, green and blue. The filters are utilized at the transmitter and at the receiver to "pick out" the hues.

For example, when the transmitter filter "sees" blue, certain impulses are broadcast that actuate the blue filter at the receiver, so that blue is streaked in the proper place on the received picture. It is all done in a flash so that the televiewed sees the picture exactly as the transmitter's filter-equipped eye saw it. At the receiver the filters are arranged on a disk whirled by a motor inside the cabinet.

Inquiry whether existing television sets could be converted to "see" color, the engineers said that no doubt an attachment could be built, but that it was too early to figure the cost.

SIGNO-MARKER PRICE TILT

The price of Signo-Marker, projection room film marker that is used to eliminate mutilation of prints, has been raised to $2.50 effective immediately, in line with previous announcement by the manufacturer, Clint Phare Products, 282 E. 214 St., Euclid, Ohio.

Transition in the Equipment Field

WITHIN less than a year radical changes have been effected in the equipment supply and service branches of the motion picture projection field. So subtly as to be almost imperceptible have these switches in policy been accomplished that the majority of independent theatre supply dealers, the group which has the most to lose in the process, and practically no projectionists have been or are even now aware of the transition.

The main driving power for this realignment of policies is derived principally from the two major service organizations in the field, RCA and Altec, and the pivot upon which their activities in this direction turn is the question of inclusive service. This latter term is frowned upon by both organizations, but philological distillation discloses ample warrant for that appellation. Lending active though surreptitious aid to the service outfits are several manufacturers and supply units which have long been identified with the projection field.

Both RCA and Altec at present are in the theatre supply business up to their respective necks—the one openly and the other indirectly. However strenuously both organizations might protest the accuracy of this observation, such utterances would be wholly discredited by the activities of their field agents. True, Altec's present policy is to put equipment requisitions through established sources of supply, but this boils down to "indirect" participation.

If pressed for the reason for their current interest in the theatre supply business, both RCA and Altec would justify their policies by stating that it was necessary in order to protect their respective interests each against the other. I. P. has always maintained that it is but a step from the level of "recommending" equipment purchases, keystone of the inclusive service plan, to the plane of actually accepting orders for and outright dealing in equipment.

● Possible Concentration of Equipment Sale Power

Meanwhile through all this pulling and hauling behind the scenes the independent supply dealer remains somnolent, as of yore, although he is the fellow who stands to lose the most through the aforementioned activities by the service groups. Whether equipment sales by the service group would benefit or hurt the theatre field remains to be seen; although I. P. would resist strenuously the concentration of control over equipment sales in the hands of only one or two groups.

If the question of inclusive servicing is the hinge upon which this whole matter turns, then obviously the crying need of the moment is a clear-cut declaration on the part of the organized projectionist craft as to where it stands on this question. I P. has tried for months to obtain an answer to this question, and while it has received numerous personal expressions from individual projectionists, and a few declarations by scattered Local Unions, its efforts to ascertain the stand of the organized craft as a whole have been attended by a remarkable lack of success.

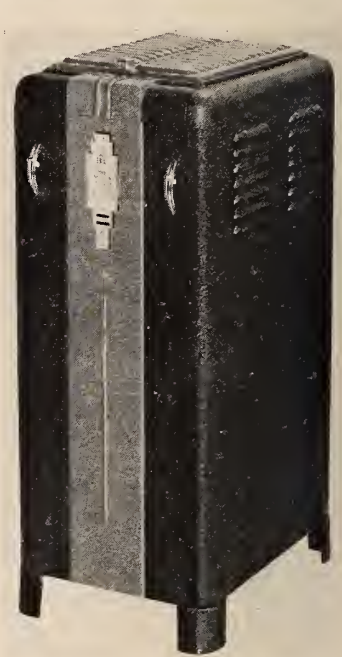
The welfare of projectionists is I. P.'s primary concern; and if inclusive service or any other plan that may be evolved is approved by the craft as a whole, it will be O. K. with I. P.—excepting, of course, that I. P. reserves the right to critically assay any such scheme and place the facts before its readers. Once this latter duty is discharged, however, the craft may pursue any course it may elect for itself without even a whisper thereon in these columns.

So there you have it. Excepting the one angle of possible concentration of power over equipment sales previously mentioned, the craft and the independent theatre supply dealers can work out this problm to their own satisfaction from here on out.—J. J. F.

B-L's New Copper-Oxide and Tube Projection Rectifiers

A new and complete line of rectifiers for motion picture projection, both of the copper-oxide and the tube type and including both single and duplex units, has been announced by Benwood-Linze Co., of St. Louis, Mo., specialists for many years in building rectifying elements for industrial applications.

The B-L tube rectifiers embody many unusual features, including an automatic feature for limiting the striking current, thus assuring long tube life and carbon economy. Moving parts have been entirely eliminated, thus simplifying the service problem. Rugged transformers, a heavy bakelite control panel, special beryllium copper contact clips, rigid cabinet construction and low installation cost are other features of this type rectifier.



New B-L C. O. Rectifier

In the copper-oxide units B-L has put special emphasis upon improved circulation of air through the unit and on many distinctive electrical features which contribute to greater efficiency and more security. All models are provided with magnetic contactor remote control in both rectifier and fan. Limited striking current also features these c-o units, and it is noteworthy that no bolting down or special foundations are required for installation.

B-L rectifiers are very conservatively rated and will provide the full output as indicated with liberal tolerances. An overall efficiency of 70% is claimed for these units. Detailed information anent these rectifiers may be had upon application direct to B-L.

FREE MOVIES AT TAVERNS

Inquiry as to the effect of free motion pictures in a beer garden in Syracuse, N. Y., upon local exhibitors and the Union elicited the following comment from Local 376:

"The equipment used is 16 mm. with sound, which is rented from a L. U. 376 member. Pictures are run six nights a week in an outdoor beer garden, weather permitting. The garden employs L. U. 376 members exclusively. There have been no adverse comments from local theatre managers." That's that.

ULTRAPHONE SELLS TO RCA

Ultraphone Sound Equipment Co., of Minneapolis, has advised all its theatre accounts of its discontinuance in business and its sale to RCA of its stock of replacement parts. RCA has entered a bid for the future servicing and parts supply of all Ultraphone units.

Frosch T. S. Co., of Minneapolis, will act as distributor of Ultraphone parts in RCA's behalf, with orders being accepted by either Frosch or RCA in Camden.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

SOUNDHEAD optical systems occasionally do become filled with oil even though they are carefully sealed when assembled. An easy method to reduce the possibility of oil getting into the lens barrel is to wipe off the optical systems just before closing down for the night, because the hour or so after the show while the opticals are cooling off is the most likely time for the oil to get in. The reason for this is as follows:

During operating hours the opticals become heated from the exciter lamps. This causes the air inside the unit to become heated and expand so that some of it is forced from the lens tube. Then when the equipment is shut down, the air inside cools with the lens barrel and a vacuum is created which draws air into the barrel. It is obvious then that any oil present may also be drawn into the barrel. If the outside of the unit is kept dry during this cooling period, the inside will stay free from oil.—R. O. NORTHRUP, RCA, *New York.*

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Usually wick type bearings are over oiled, with resulting damage to commutators or to starting switches. A simple test can be made by inserting a screw driver or Allen wrench in the oil hole and compressing the wick somewhat. If the tool comes out dry or just greasy, oil should be added; if enough oil adheres so some can be wiped off on the fingers, there is sufficient oil. — W. J. STRIEBY, RCA, *Baltimore.*

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I have seen considerable trouble result from the ropes opening and closing the curtain slipping on the motor pulley, so that the curtain would not always completely open or close.

One of my theatres is using steel wool instead of sand in the sand tray of their arc lamps. The result appears to be exceptionally good, since not a single pit mark has been put on the mirrors since that time. The wool seems to function as to be expected, that is, the hot copper sinks into the steel wool, some hardens in the wool, other runs through and does not strike the pan with enough force to splash.—H. J. BROWN, Altec, *Allentown, Pa.*

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It is not uncommon to encounter installations where the pinion gear of the W.E. 712 drive wears faster than usual. This can often be traced to improper alignment of the shaft and gear as a result of bolting the Simplex head to the 700-A adapter plate before installation of the drive so that when the drive is installed and clamped down to the supporting bracket the shaft is thrown out of line and causes the gear to wear rapidly.

When installing a Simplex head on a 700-A adapter, the 712-A drive should be bolted fast to the supporting bracket before the projector head is screwed in place. This will insure the drive and head being in proper alignment and prevent rapid wear of the pinion gear.—O. K. WEATHERWAX, Altec, *Atlanta.*

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A remedy for this has been found in the following: Remove the motor from the floor where it is usually fastened, and bolt it to a heavy board, about four feet long. Fasten this board to the floor in such a position that the motor comes in its normal position, with a hinge. Have the rope of such a length that the motor floats about four inches above the floor.

The weight of the motor is usually sufficient to keep slippage from occurring, but additional weight or a spring could be added if necessary. As the rope stretches, the motor moves with it, and always keeps the motor tight and properly centered so that the curtain stops in the correct positions.—P. C. MCGAUGHEY, RCA, *Boston.*

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Much time and temper is wasted replacing 42 and other multi-prong tubes back in sockets after test or in an emergency. To avoid this, all tubes should be marked before removal with a red film crayon, one marking when the tube is hot will usually last the life of the tube.—D. WADDELL, RCA, *Boston.*

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It is generally known that in case of failure of a W.E. 708-A motor control cabinet the show can be continued by connecting the leads which normally go to terminals 3 and 4 of the control cabinet to a rheostat which can then be adjusted to control the motor speed. Since the resistance value of the rheostat must be low and the current capacity relatively large, one of the most common stunts is to make a salt water rheostat consisting of adjustable electrode suspended in a pail of salt water. This is the hard way.

I have found that a quick way of temporarily clearing 708-A motor control cabinet troubles is to use a KS-6684 rheostat which is commonly used to control the current to the 8.5, 4-ampere exciter lamps. It makes an excellent speed control resistance and eliminates the necessity of tedious process of making up a salt water bucket resistor. The KS-6684 rheostat is suitable for use for only a short period in an emergency since it heats up to a dull red color. It must be adequately protected from coming into contact with anything that burns.—G. H. MILLER, Altec, *New York.*

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Inductive hum intensity and "minimum pick-up angle" can be determined easily by using a midget radio speaker as an "exploring" unit in connection with an amplifier. The voice coil is connected to amplifier input and by placing the speaker in different positions relative to the unit causing hum, the effects of hum can be determined; earphone or loudspeaker being used at amplifier output. Incidentally, if this application is of particular importance in any case, the use of an "exploring" coil could be increased by tuning it to 120 cycles, or other frequencies desired.—R. H. BISBEE, RCA, *New York.*

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I recently encountered a case of trouble of radio interference on a Simplex type "B" system. Application of all the usual corrections such as standard chokes, condensers and wave traps failed to eliminate the trouble.

Correction was affected, however, by means of a home-made choke constructed out of 40 turns of No. 18 enunciator wire such as commonly used to wire door bells and buzzers. A home-made choke was placed in each speech line of the horn network and entirely eliminated the radio pickup. — P. V. WOOLEY, Altec, *Indianapolis.*

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Last month I answered a trouble call report of insufficient volume and found that the line voltage had dropped as low as 92. The theatre was operating on top step and could get just barely enough volume to hold its patrons.

The low line voltage developed during an electrical storm. Such a condition is

not unusual during the summer months when heavy lightning storms often occur. —F. J. Homsher, Altec, *North Hills, Pa.*

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Many persistent noises with W.E. Universal Bases can be traced to the p.e.c. anode connecting blocks. A loose mounting screw or a loose block will make quite a racket. The remedy is to see that the screws are tight and the screw heads grounded to the casting of the sound unit by scraping the paint from the surface of the latter.

If the threads are stripped in one of the screw holes, remove the screw entirely, because the minute movement of the loose screw may cause noise.—P. J. Aubry, Altec, *Atlanta.*

HERE is a candidate for the screwy trouble prize: the theatre reported poor quality and oscillation when the main amplifier was turned on. It was easy to localize the trouble as being in the amplifier, but determining the definite cause was another thing.

Quoting from the emergency call report: "The oscillation could be stopped by carefully springing the center of the amplifier chassis longitudinally, that is, by squeezing the tops of condenser C-3 and transformer T-2 toward each other, or springing the top of condenser C-3. It was then found that the trouble could be reintroduced by reversing the aforementioned process. This sequence could be repeated. Insulating the bottom of C-4 from the chassis and making the various can ground leads clear the chassis holes seemed to stabilize the operation, making it much more difficult to reproduce the trouble. The amplifier failed once during the evening show and was corrected immediately by moving condenser C-4. The trouble was evidently due to defective condensers C-4, and others."—W. R. Widenor, Altec, *Phila.*

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Trouble may come and trouble may go, but it is the trouble which travels the most devious route that is the hardest to locate. Everybody knows what happens when external light gets into the p.e.c. compartment and strikes the cell—noise ensues. A case was experienced in a Chicago theatre where the projected light from the projector in passing through the glass ports was reflected back into the room, struck a shiny fixture on the sound unit and was then reflected through a crack into the p.e.c. compartment and on to the cell. The result was motor-boating at the shutter frequency.

The noise, not loud, existed for sometime before its cause was located. One day the inspector was bending over close to the porthole looking at the reproducer set and noticed that whenever he assumed a certain position the noise stopped. His head was blocking the stray light reflected from the porthole glass.—W. W. Simons, Altec, *N. Y.*

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Mercury vapor tubes are peculiar animals in that they must be turned to filament and heated up before they can be put into operation and they are subject to flashover and damage if excessive voltages are applied. These characteristics must be closely heeded or loss of sound may become permanent unless a good stock of spare tubes are at hand.

If the power supplied to the theatre ever goes off it is extremely important that any apparatus containing mercury vapor rectifier tubes, in particular, be turned off immediately. If not, when the power goes on the filament and plate potentials will be applied simultaneously to a cold tube and flash-over will occur. Furthermore, it is often the case that when the power supply goes off, it comes back with a surge which subjects the tubes to a high damaging potential.

Such a case occurred recently at one of my theatres. I was called because of a no-sound condition and found that a severe electrical storm was occurring when the trouble developed. During the storm the power supply failed entirely and in the ensuing darkness the rectifier apparatus had not been turned off. Shortly afterwards the power came on unannounced with an excessive surge. The mercury vapor rectifier tube flashed over causing the fuses to blow out.—E. A. Briggs, Altec, *Kansas City.*

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No doubt, some of the boys have had the split nut on the Simplex take-up spindle assembly break when attempting to adjust this take-up. Inasmuch as there is a special thread on this shaft, no standard nut will fit it. If no supply house be accessible, you may experience a lot of difficulty in attempting to repair the broken part.

A good temporary expedient is to obtain an ordinary radiator hose clamp of the proper size and slip it over the nut. Tighten up on the hose clamp set screw, and the nut performs as good as new.—E. A. Doyle, R.C.A., *San Francisco.*

• • •

The drive motor of the W.E. TA-7400 reproducer utilizes spacer washers on the switch assembly. Reassembling the motor and switch assembly is greatly facilitated by using shellac on the spacer washers.—J. H. Littenberg, Altec, *New York.*

• • •

The manager turned in an emergency call reporting, literally, "all radio sets in town have to be shut down due to noise when show is started".

It was found that between bad insulation of the Neon sign wiring and poor arc generator commutation, a veritable barrage of static was being broadcast and practically blanketing the entire town.—C. R. Archer, Altec, *Bangor, Me.*

• • •

From time to time when making calls at theatres equipped with 211 reproducer sets, I notice there is a difference of quality between machines. Upon investigation I often find that a lens assembly is out of adjustment.

I was at a loss to account for this condition until I saw a projectionist cleaning the end of the lens near the scanner without first removing the prism assembly. He was using a soft rag held with a pair of tweezers. The ball of rag was large enough, when forced between the objective lens and the prism, to push the lens tube back against the spring. Since the adjusting nut on the lens holder is usually a loose fit, if the projectionist happened to touch this nut when the lens was pushed back, the critical focus adjustment was upset.

Projectionists should watch this point closely.—L. F. Whitney, Altec, *New York.*

• • •

Here is an instance where the expression "A monkey wrench in the works" was found to be literally true: the theatre reported that it was impossible to obtain current for the amplifier filaments or the exciter lamps. The output of the KS-5259 Motor Generator was only 3 volts, approximately 15 volts below normal.

After running through the usual quick checks, the culprit was found to be a small wrench lodged underneath the motor generator field resistor, thus grounding the resistor and short-circuiting the generator output. Evidently the wrench had been laid on the base of the motor generator and forgotten. And the constant vibration of the motor generator in operation had caused the wrench to slowly slide underneath the field resistor and gum up the works.—F. E. Howell, Altec, *Los Angeles.*

RCA PORTABLE P. A. SYSTEM

A newly-designed 15-watt portable public address system, PG-180, for indoor audiences of up to 2,000 persons has been announced by RCA, at a 15 percent lower price than the popular 12-watt system it replaces.

Improved cables designed to withstand the abnormal wear of portable use are employed for the first time. Basic unit is the latest RCA amplifier MI-12202. The two loudspeakers are 10¼" permanent field types, while the microphone is the junior velocity type mounted on a table stand. Two separate input circuits with individual volume controls are provided for high-impedance inputs.

Increased length of all cables, permitting greater freedom for the system and widening its field of applications, is another feature. Entire unit packs into one case measuring 21 inches high, 16¾ inches wide, 11 inches deep, and weighing 43 pounds. It is covered with a wear-resistant black fabric.

ALTEC SIGNS VETS.' HOSPITALS

Altec Service Corp. has signed with the U. S. Veterans' Administration to provide sound service and to supply both sound and visual projection parts for the projection equipment in the government's 91 veterans' hospitals, of which there is at least one in every state. The contract covers a period of ten years.

Still widely prevalent, although the easiest projection defect to cure, is that hoary old deficiency of excessive noise filtering through from the projection room to the theatre auditorium. Not loud talking alone but the clatter of tools and equipment units is the composition of this din. Can it—and we mean this literally.

RECORDING AND TELEVISION FEATURE SMPE MEETING

(*Continued from page* 12)

with the Hotel Mark Hopkins for single accommodations for $5 daily and double with twin beds for $7, both with baths. The Fairmont Hotel also extends a rate of $4 single and $6 double, with bath. Reservations may be made by writing the Hotel.

Abstracts of some of the technical papers and demonstrations to be given at the Convention are appended hereto:

A LINE TYPE OF MICROPHONE FOR SPEECH PICK-UP

L. J. Anderson
RCA Manufacturing Co.

This paper deals with the development of a line type of microphone having directional characteristics which are relatively independent of frequency, and which are of such size as to be readily portable. Uniform directional characteristics are obtained by constructing the line in such a way that the effective length becomes less with increasing frequency. Physical size limitations are largely responsible for confining the microphone to speech pick-up applications.

A 200-MIL VARIABLE-AREA MODULATOR

R. W. Benfer and G. T. Lorance
Electrical Research Products, Inc.

A modulator using a new vibrating-mirror unit has been developed for recording double-width variable-area sound-track. The noise-reduction shutter is at the slit, making it possible to record, with noise reduction, Class *A* push-pull track comprising two standard bilateral tracks, one of which is located in accordance with the dimensional standards for single track. While this has been its principal use to date, it is readily adaptable for other types of track.

A visual monitor shows operation of the noise-reduction shutter and the amplitude of signal modulation in both directions from the base-line with a positive indication of peak overload. An exposure meter is included to serve as a check on lamp current and track balance. The light-source is a tungsten filament lamp which will properly expose fine grain emulsions to "white" light or standard emulsions through an ultraviolet filter.

STABILIZED DISK CUTTERS

S. J. Begun
Brush Development Co.

Where it is desirable to obtain good quality in disk recording, the cutter used must have a wide frequency range and a low content of harmonic distortion. Furthermore, care must be exercised that the sensitivity of such a cutting device should not be affected by temperature changes. This is particularly important in case the recording equipment, for some reason, does not work in air-conditioned rooms.

The sensitivity, as well as the amount of harmonic distortion generated for magnetic and crystal cutters, depends upon the temperature. In a magnetic cutter, the characteristic of the damping material varies sufficiently with temperature change to require constant temperature conditions.

With respect to a crystal cutter, it has been found that a crystal element will drive a recording stylus with negligible distortion if its temperature is of the order of 30°C or above. For this reason, a crystal cutter has been developed with a built-in thermostat to control a heating element, which will keep the cutter temperature constant within narrow limits.

The design of such a cutter and the performance characteristic are described in detail. The high degree of stability of such a temperature-controlled cutter is shown.

A PORTABLE DISK RECORDING-REPRODUCING MACHINE

J. C. Davidson and C. C. Davis
Electrical Research Products, Inc.

The *RA*-280 equipment is intended as a portable high-quality disk recording and reproducing machine. It was designed primarily to include a feed-back recorder, a vertical and lateral reproducer, and an amplifier with equalizers and suitable switching arrangement for recording or reproducing.

The turntable drive includes an electrically and mechanically balanced motor, a precision worm and gear, and an oil damped mechanical filter. Vibration is prevented from reaching the turntable by a bellows type coupling. The filter consists of a reed-type spring surrounded in oil and provided with suitable linkage to the turntable.

It is felt the electrical and mechanical requirements for a high quality machine have been met. The frequency flutter has been maintained at ±0.03 to ±0.06 per

Don't Fool Yourself



Your low intensity lamps may be as good as the day you bought them, BUT today they don't project as bright a picture because of the new density of black-and-white films. Nor is it possible to properly project colored films with them. Today it's necessary to double your light and have a snow-white light, in order to secure a desired screen brilliancy. But that's no problem with the new Strong Utility High Intensity Lamps, and it costs only 2c. more per hour. An Independent Theatre Supply Dealer will arrange a demonstration in your theatre without obligation.

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ENGINEERED FLEXIBILITY
plus
RESERVE POWER
equals
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FOREST RECTIFIERS give the projectionist 'Freedom of Action'. He can meet any emergency due to poor light on the screen because of Forest 'Engineered Flexibility'. Should more amperage be necessary to improve projection, Forest equipment has 'Reserve Power'. There is no equal for Forest Power Conversion Equipment!

FOREST Super Magnesium-Copper Sulphide Rectifiers, with the newly developed FOREST transformer, give definite assurance of protection from line voltage fluctuations. The Super MCS has—reliable 3 phase fan . . . magnetic switches . . . visual 3 phase line indicator . . . automatic voltage regulator . . . housed in a new sturdily built modernistic case—all distinct FOREST features. Approved by Underwriters Laboratories. Only FOREST offers the TWIN-TYPE rectifier.

LD-60 BULB TYPE RECTIFIERS meet the demand for a reliable, efficient, low cost power conversion device to supply projection arcs.

FOREST LD-60 rectifiers have an output from 30 to 60 amperes for Simplified High Intensity, Suprex, the new Intermediate High Intensity and Low Intensity operation.

FOREST 'Universal Trim' PROJECTION ARC LAMP does what all other lamps claim to do—Combined. It will accommodate any carbon trim; from 5 to 9 mm. negative and 6 to 13 mm. positive. This D.C. lamp can be operated from 30 to 65 amperes. Suprex-Simplified High Intensity, Intermediate High Intensity (One Kilowatt Arc) or Low Intensity projection is possible with one lamp!

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cent and mechanical-noise pick-up is below the threshold of feeling and shows no optical pattern in the recording.

AN IMPROVED PLAYBACK HORN EQUIPMENT

G. R. Daily

Paramount Pictures, Inc.

A dolly-mounted, high-quality two-way horn system for playback and announcing service on production recording stages is described. A reflex-type horn cabinet is mounted on a four-wheel steerable dolly, together with a 50-watt amplifier and cable reel. The horn unit can be rotated on the dolly to direct it at the action, or be readily removed from the dolly for use on parallels, or suspended from ceiling girders.

An extension connection is provided for a W.E. 750-*A* speaker for low-level direct recording of playbacks. An extension director cut-out horn control is provided. The mixers' playback control box provides, (*a*) mixing from any two of four film or disk input positions; (*b*) extensions for cueing by phone monitored by the director or actors; (c) connections for portable disk recording from a bridging circuit across the film recording main amplifier output, and (*d*) film recording connection from the playback circuit.

IMPROVED MOTOR DRIVE FOR SELF-PHASING OF PROCESS PROJECTION EQUIPMENT

H. G. Tasker

Paramount Pictures, Inc.

Process projection photography requires that the shutter of the projector and that of the camera open and close simultaneously. The relation between the shutter speeds and the pole frequencies of normal motion picture motor systems is such that there may be one, four, or five incorrect shutter relationships for each correct one, if the motors are interlocked at random.

Earlier methods of insuring correct phasing between camera and projector shutters did not take proper account of the economic importance of fast and reliable operation. This paper presents the results of a time and economic study indicating savings of many thousands of dollars annually per studio. accruing from the use of a motor system which automatically phases the shutters of camera and projector, and which has a very high degree of reliability.

The design and performance features of such a motor system are described in their relation to earlier efforts along this same line, together with a report on three months' production use on the new system.

TWENTIETH CENTURY CAMERA

G. Laube

Twentieth Century Fox Film Corp.

Offering a means for cutting costs of production and fitting admirably in the picture of modern streamline equipment, the new 20th Century Silenced Camera recently made its official debut to an assembly of cine-technicians and cameramen. Although the camera was designed primarily to reduce noise, it also embodies many of those conveniences and devices which spell speed and aid in cost cutting.

The camera has been designed and built along new principles and, instead of trying to hold the noise in the camera case

or the blimp, the noise has been reduced at its source to the end that the fast-moving reciprocating parts are as light and as small as possible and when assembled yield uniform acceleration and deceleration, with a resultant optimum movement of the film and a reduction in noise-making vibration. This, when coupled with a patented sound insulating mount for the film moving mechanism, reduces the noise output to a level substantially equivalent to the noise level of the best blimped camera available. Other features included in the camera are described in the paper.

ELECTROOPTICAL SLATING AND CUEING DEVICE

D. B. Clark

Twentieth Century Fox Film Corp.

As a direct result of the necessity of reducing budgets and cutting corners in motion picture production, many labor-saving devices have lately become evident in the studios. Among the more important of these is a new slating device developed and used by the camera department of the 20th Century-Fox studios.

Designed mainly to save time and film and to put bigger and better slates on the film, the device is a complete unit comprising its own optical system, its own illumination, and carries means for mounting various changeable indicia. These are all assembled in a small casing adapted to be swung into and out of a photographing position a few inches in front of the camera lens to slate the film in the camera.

When not in use, the device hangs inconspicuously beneath the sunshade, where it is readily accessible for changing the indicia for successive shots and is easily swung into slating position by a simple twist of the wrist by the camera operator. When using the slating device in production, the camera case need not be opened for cueing and marking takes. This is done photographically, and the film ordinarily wasted by needless exposures is saved for use.

One of the novel features resides in the indicia carrier member which is designed to provide a smooth flat field, including the changeable numbers to yield a clean-cut reflection when the indicia is projected on to the film, said carrier member being readily removable from the casing for changing the data.

In operation the device is swung into a photographing position within the sunshade directly in front of the camera lens before the camera starts turning and, since the device itself blocks off all light except the illuminated indicia, the first frame of the slate can be used as a synch. mark or a cue mark. Under this arrangement, the slating indicia would be photographed on the film while the camera was coming up to speed, thus saving film which is ordinarily lost. Provision is made for operating the illuminating light either from a battery or the 220 a-c that drives the camera motor, the light being controlled by a switch that automatically cuts in as the device is moved into a photographing position.

PHOTOELECTRIC METHOD OF RATING THE LIGHT-SPEEDS OF LENSES

D. B. Clark

Twentieth Century Fox Film Corp.

Photographers and cinematographers have realized for some time that something was

SURFACE TREATED LENSES

25% MORE ILLUMINATION

WITH A B&L SUPER CINEPHOR f:2



NOW, with the Bausch & Lomb Super Cinephor f:2, light previously lost by lens surface reflections (4 to 6% at each air to glass surface) is converted into additional screen illumination. A new process of treating lens surfaces which reduces surface reflections to a minimum is responsible for the performance of this f:2 lens which now has the efficiency which heretofore would have been possible with an f:1.79 lens.

Greater contrast and crispness and more clearly defined shadow detail are evident. Color films are projected with greater purity and brilliance. For complete details, write to Bausch & Lomb Optical Company, 616 St. Paul Street, Rochester, N. Y.

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wrong with the present method of calibrating light-stops on lenses. As various makes of lenses were interchanged on shots throughout the making of a motion picture, it became more and more obvious that the *f/* rating did not represent a true value of the light-transmitting capacity of the lens.

As a result the real tough job of a cameraman has been to match negative densities in a procession of shots that have been made on lenses of different makes, different focal lengths, and different stops.

Even though the lenses are rated as to light-speed and calibrated under the *f/* system, it is still a guessing game, since some of these ratings are as much as in error when reduced to actual transmitting capacity of the lens. Since the *f/* system is the only system used at present for rating the light-speed of lenses, cameramen have been forced to use this system but have found that it is merely a guide and can not be depended upon where accuracy is required.

In view of all this, it is believed that a system for rating the light-speed of all lenses based upon actual light transmitted through the lens, regardless of make, size, or any other physical characteristic of the lens, should be of value not only to lens makers, to give them a reading on the overall efficiency of the lens, but also to the cinematographer, to give him an actual effective rating as to the light-valving capacity of the lens.

Such a system has been used in rating all lenses in the camera department of this studio. Disregarding all physical dimensions or characteristics, each lens in the department was calibrated according to the actual value of effective light transmitted with respect to a predetermined reference base.

The reference base was established by measuring the effective light transmitted through a 35-mm lens set at *f*/3.2, the source of light being a uniformly lighted field of fixed intensity. This same field was used as the source of light for all lens calibrations. The result was a lens system wherein a light-speed rating represents the same amount of light regardless of make or size of the lens and where the different light-stops on the different lenses indicate a true proportional value of the basic light.

A NEW TREATMENT FOR THE PREVENTION OF FILM ABRASION AND OIL MOTTLE

R. H. Talbot
Eastman Kodak Co.

A new type of lacquer has been devised which may be simply and rapidly applied to either one or both sides of 16- and 35-mm films and which may be readily removed in ordinary processing equipment by the use of carbonate solution. The function of the lacquer is to absorb all the ordinary cinch marks and other abrasions commonly found in cine films which have been in service in the trade.

Tests in the field have indicated that the lacquer is somewhat more resistant to abrasion than are the normal film surfaces. When the lacquer has been removed and replaced with a fresh coat, the film is found to be in essentially as good condition as when new. The lacquer is useful in protecting negatives, master positives, duplicating negatives, and prints from all ordinary abrasions. In addition, the lacquer because of its glossy surface eliminates the mottle or flicker on the screen due to oil on the film.

REPORT OF THE COMMITTEE ON PRESERVATION OF FILM

J. G. Bradley
Chairman

A statement of the work of the Committee as a whole and individual reports of sub-committees on the following subjects: (1) handling and winding of film; (2) safe and economical storage, size of vent per unit weight of film determined, microfilm testing methods developed; and (3) printers for old and shrunken film.

PRODUCTION QUALITY SOUND WITH SINGLE SYSTEM PORTABLE EQUIPMENT

D. Y. Bradshaw
March of Time

The *March of Time* requires equipment of great portability and simplicity of operation, yet retaining good quality. By using Class *B* push-pull, variable-area recording, a complete noise-reduction sound system weighing fifty pounds was obtained. This single system was used in production of the feature picture *The Ramparts We Watch.*

Problems arise from (1) recording on panchromatic negative, (2) lack of control over negative processing, (3) instability of recording unit caused by rough use of camera on which it is mounted, and (4) distortion due to lateral track

shift. Means for overcoming these handicaps sufficiently have been found. Single system can be used without great sacrifice in quality, where time and space are factors.

SOME LABORATORY PROBLEMS IN PROCESSING 16-MM SOUND WITH BLACK-AND-WHITE AND COLOR FILMS

Wm. H. Offenhauser, Jr.,

Precision Film Laboratories

The duplication of 16-mm films involves many relatively intricate problems not encountered in the laboratory processing of 35-mm sound-films. These problems have given rise to procedures and apparatus radically different from those in use in 35-mm.

The two major differenes that are especially significant are (1) the use of reversal for original films; (2) the existence of but one row of sprocket-holes on the 16-mm sound-film.

It is interesting to note that all our present standards in 16-mm blindly assume the negative-positive method of operation; ignoring entirely the reversal and Kodachrome. At the present time even the emulsion position of the 16-mm film is standardized on the basis of a 35-mm sound negative and 35-mm picture negative as originals. As a result, our 16-mm dimensions so derived from 35-mm are inconsistent with the projector dimensions at present in use, and inconsistent with the pressing needs arising from the direct 16-mm field.

Much of the difficulty arises from the rather obvious lack of concern displayed by the 35-mm entertainment industry and the very rapid simultaneous growth of direct 16-mm in educational and industrial applications especially in connection with the duplication of sound on Kodachrome.

Some of the special processes and special apparatus features involved are described which have made possible workable solutions to the problems involved.

SOME OBSERVATIONS ON LATENT IMAGE STABILITY OF MOTION PICTURE FILM

K. Famulener and E. Loessel

Agfa Ansco Corp.

The observations reported are the result of an investigation to determine definitely the effect of a delay between the exposure and development of modern motion picture films. The stability of the latent image in terms of speed, gradation, graininess, and color response has been studied.

In general, a definite speed increase was noted on negative emulsions, a decrease on positive emulsions. There were also changes in gradation and graininess. The detailed findings, which vary considerably with the individual emulsion type are given, followed by a general discussion and interpretation of the results. A brief review of the literature is included.

REDUCTION OF SPROCKET-HOLE MODULATION IN FILM PROCESSING

M. Leshing, T. Ingman, and K. Pier

Twentieth Century Fox Film Corp.

One of the contributing factors to sound-track degradation is sprocket-hole modulation. This is probably more commonly known as 96-cycle modulation and results from non-uniform action of developer around the perforation holes during the time of processing. Its chief remedy is turbulation.

The practical aspects of controlling the amount of sprocket-hole modulation is described herein. Curves showing the increase of this distortion due to diminished turbulation are included as well as those showing the inter-modulation of recorded sound by sprocket-hole agitation. Photographs showing various types of sprocket-

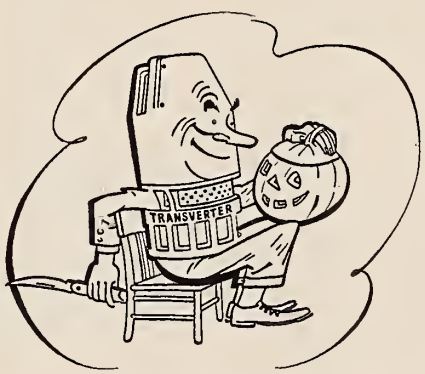


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hole modulation are also presented. There are also shown samples of modulation contributed by developing machines through mechanical defects, such as pressure created by binding rollers and mechanical frictions introduced in the processing machine proper.

A complete description of the turbulation methods employed at the Film Laboratory of 20th Century-Fox Film Corp. at Hollywood is disclosed and the various sensitometric means of control relative to this problem are given.

NBC TELEVISION COVERS THE REPUBLICAN NATIONAL CONVENTION OF 1940

H. P. See
National Broadcasting Co.

Television transmission facilities were installed at the Republican National Convention of 1940. This marked the first time that a news event of national importance, transpiring at a point greater than twenty-five miles distant from New York City, was successfully televised and viewed by NBC's television audience in the New York Metropolitan Area. Program transmission was continuously maintained during each of five daily sessions. These transmissions totaled thirty-three hours and seventeen minutes.

This paper describes the method by which NBC originated the television pictures at Philadelphia and transmitted them through the facilities of the Bell System to New York, where they were radiated from Station W2XBS, the television transmitter atop the Empire State Building tower. The signals from New York were received by the General Electric Co. by means of a specially constructed receiving system near Schenectady and re-transmitted on Station W2XB to the television audience in that vicinity. The audience consisted of approximately 40,000 persons scattered throughout New York, New Jersey, and Connecticut.

The equipment and its functions are described. Reference is made to the mode and continuity of operation as distinguished from newsreel participation at the same event.

PROBLEMS IN TELEVISION IMAGE RESOLUTION

C. F. Wolcott
Gilfillan Bros., Inc.

This paper is primarily thought-provoking, and states problems involved in the consideration of suitable standards now before the National Television Systems Committee.

Resolution is discussed from a standpoint of the number of lines and fields within the limits of presently assigned channels. Related problems touched upon are flicker frequency *vs.* illumination, and some of the difficulties which must be guarded against with colored images, such as raster displacement occasioned by superimposed extraneous magnetic fields or voltages.

The effects of motion, which tend to smear detail, are discussed in relation to frame and field frequency.

The major limitations of present scanning-spot shape and intensity distribution. which determine the vertical and horizontal widths of confusion, have been removed in the laboratory, introducing the possibility of markedly improved definition with a given number of lines and fields which must be reckoned with in determining standards.

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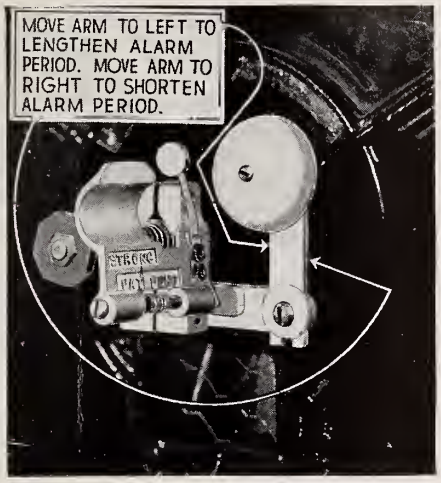
Is strictly mechanical and requires no batteries, no transformers, no governors, and no pre-setting by the projectionist.

Is not dependent upon any change in the normal smooth operation of the projector.

Is installed within 5 minutes, requiring no drilling.

Once installed, forget it—as was conclusively demonstrated by 1200 tests under practical conditions in various projection rooms.

About 75 seconds before the end of the reel the bell begins to ring, continuing distinctly for 15 seconds, after which period of time it ceases. The duration of the bell-signal can be increased or decreased about 15 seconds by simply moving the arm to either the left or the right.



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ZIPPER Changeovers for all models mount directly on the projector at the aperture and can be installed within 10 minutes without any drilling or tapping, etc., and require no brackets! A new-type treadle foot-switch, utilizing an unbreakable mercury switch, eliminates all switch trouble. Weighs only 20 ounces; guaranteed against trouble for one year after purchase.

The combination Sound-Vision Changeover is now available in all ZIPPER models for use with any RCA sound installation. This method of changeover is EXCLUSIVE with the STRONG ZIPPER, being fully covered under U. S. Patent No. 1,796,970. These combination models for RCA systems are priced at $125 per pair, including foot-switches.

ZIPPER Changeovers available for Simplex (all models) Motiograph (all models) and Kaplan projectors.

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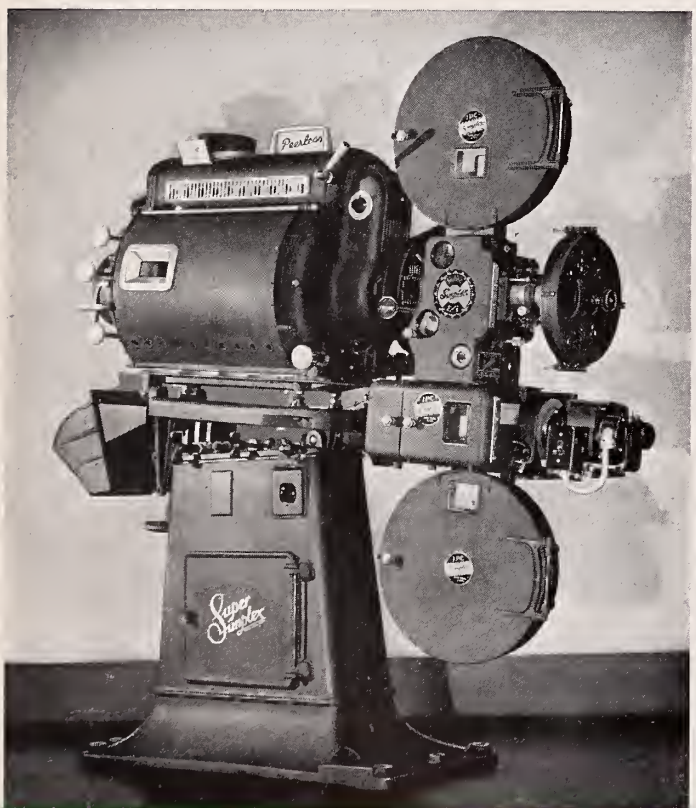
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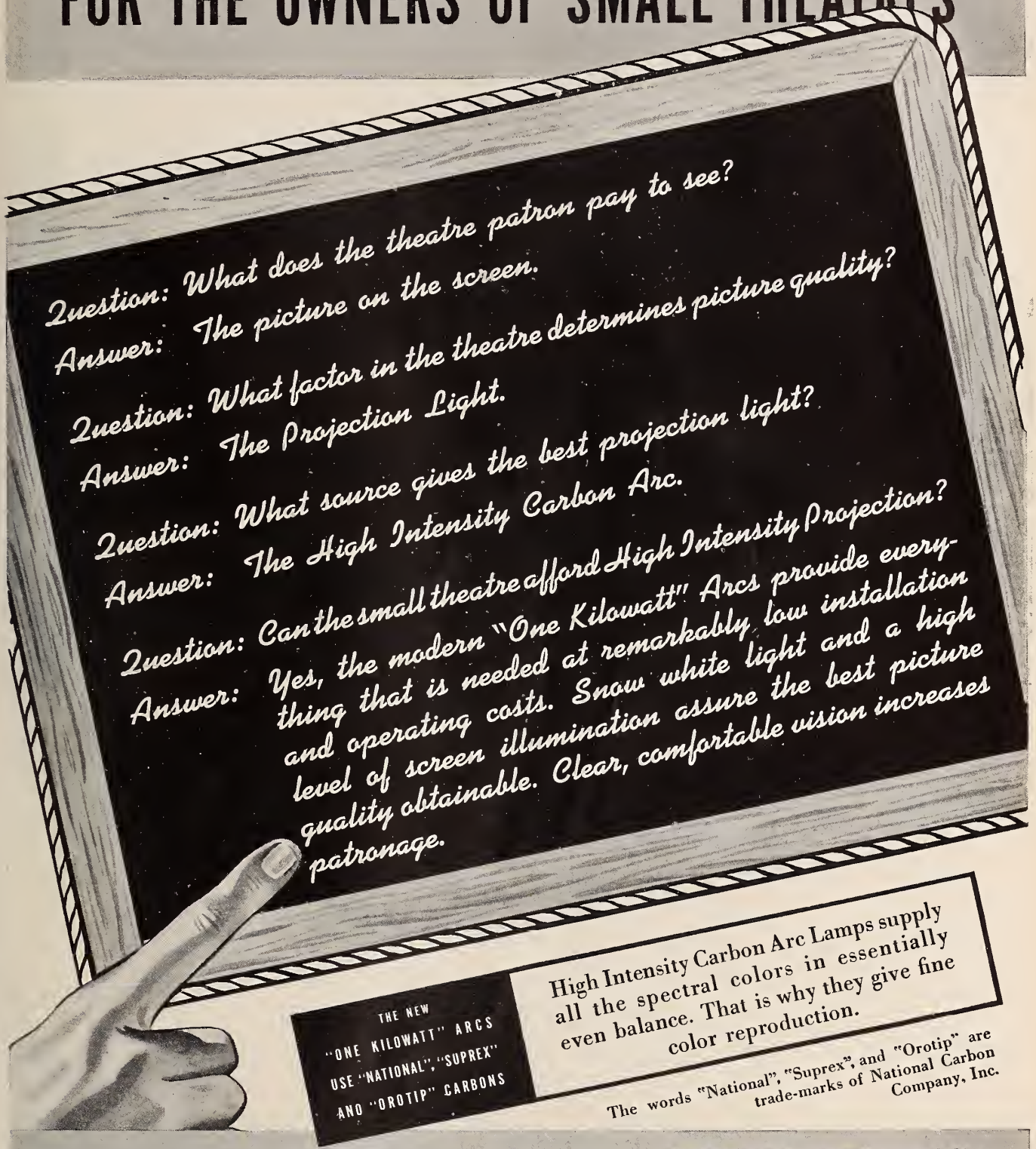
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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 15 OCTOBER 1940 *Number 10*

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Monthly Chat

YOU'LL be hearing some fantastic tales about Walt Disney's forthcoming "Fantasia" and its "anticipated" effect upon sound reproduction in "all" theatres within the next few years. A reasonable approximation of this strictly roadshow production is printed within; and we'll give you the real low-down on its technical aspects after the New York premiere on Nov. 14.

• • •

Three-dimensional movies utilizing polarized light, concerning which there has been much gab of late, still require the use of a viewing device (analyzer) by each observer, and there are difficulties in the matter of viewing angle and variations in perspective with distance of the observer from the screen.

This is not to imply that the problem can't be licked but merely to emphasize that three-dimensional movies still are some distance in the future. The use of polarized light may be a contribution in that direction.

• • •

To those of our readers who are bewildered by the many and conflicting claims anent screens which have appeared in the trade press (most of it of a non-technical nature just as it was handed to the boys from headquarters) this corner reiterates those truisms relating to screens which still hold true: that all screens get dirty; that there is no known means for efficiently washing a screen, and that the best of all possible procedures is frequent replacement of the sheet. Who says no?

• • •

Just about now when divers forces are readying for a big push into the servicing and supply fields would be a nice time to have handy for use that organization of projectionists that was so unceremoniously tossed out the window by the craft itself several years ago. Or doesn't anybody care?

• • •

As a purely precautionary measure and as protection for the present wage level, why wouldn't it be a good idea for dear old I. A. to have, say, half a dozen travelling inspectors, each with his own district to cover, roaming over the country and popping in on the boys at the most unexpected times? Better that we see the layout in general before anybody else does, particularly that guy who pays the freight. By "inspectors" is meant, of course, top-notch technical men, not pensioners.

• • •

Beaucoup foreign matter collects in one's ears and nose in a projection room over a period of time. Have a doc blow out your ears occasionally, as do a couple Chicago friends of ours. You'll be amazed at the junk that comes rolling out therefrom.



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INTERNATIONAL PROJECTIONIST

VOLUME XV OCTOBER 1940 NUMBER 10

Amplifier Power Output Data

By *R. J. KOWALSKI*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

SUCCESSIVE technical developments in the art of sound-on-film recording—such as noise-reduction shutters, ultra-violet recording, and improved film and processing methods—have made possible film records with dynamic or volume ranges comparable to those found in nature. To secure genuine realism when reproducing these film recordings, however, it is imperative that the reproducing system amplifiers have sufficient power output capacity to handle the accompanying peak loads without perceptible overload or distortion.

Since the sounds recorded during intensely dramatic sequences, such as the crumbling of the icebergs in "Spawn of the North" or the tolling of the big bell in "Hunchback of Notre Dame," are many times louder than ordinary dialogue, it is quite obvious that many times more amplifier output power is required to reproduce these sequences at the proper realistic level.

Although normal dialogue can be reproduced at a comfortable listening level in most theatres with amplifier electrical power output in the order of one to three watts, modern theatre amplifiers are designed to deliver from ten to more than one hundred and twenty watts of undistorted power output to reproduce new recordings with full dramatic effect.

Recent laboratory developments indicate that this need for greater reserve power will be even more urgent in the future. Besides helping to reproduce spectacle scenes like those aforementioned, where the need for considerable output power is obvious, adequate power also improves the quality of reproduction of dialogue and music at normal levels.

The minimum amplifier power required to give satisfactory reproduction in any given auditorium is largely dependent on the cubical volume of the auditorium and on the number of seats. The Research Council of the Academy of M.P. Arts and Sciences recently completed an extensive study of minimum power requirements for theatres. The results of their findings were published in the form of a graph shown in Fig. 1.

Note that a minimum power of 10 watts is recommended for the smallest theatres. Power requirements rise rapidly with an increase in the size of the theatre, so a 3000-seat house should have 65 watts of undistorted audio power available. The studios in Hollywood are now recording sound with these power requirements as a

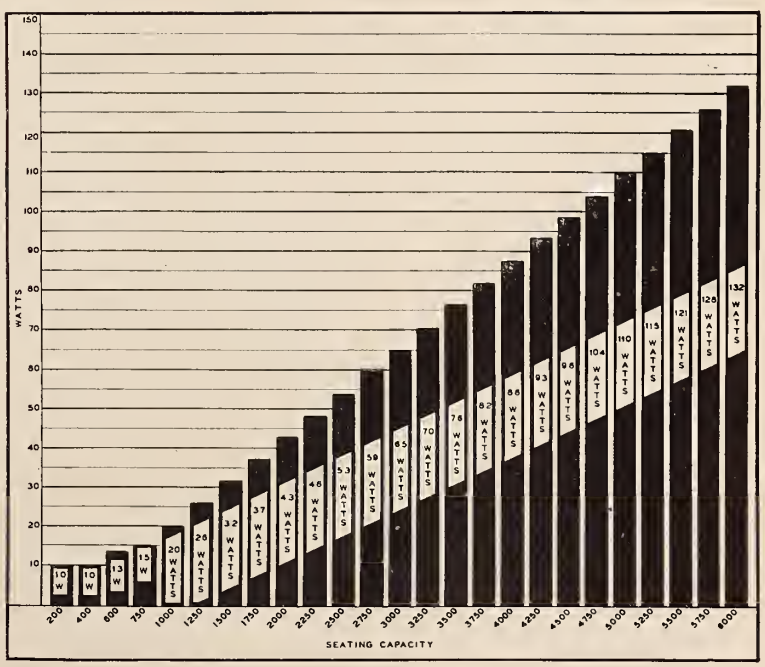


FIGURE 1 *Academy Research Council minimum power requirements for theatres, based upon seating capacity*

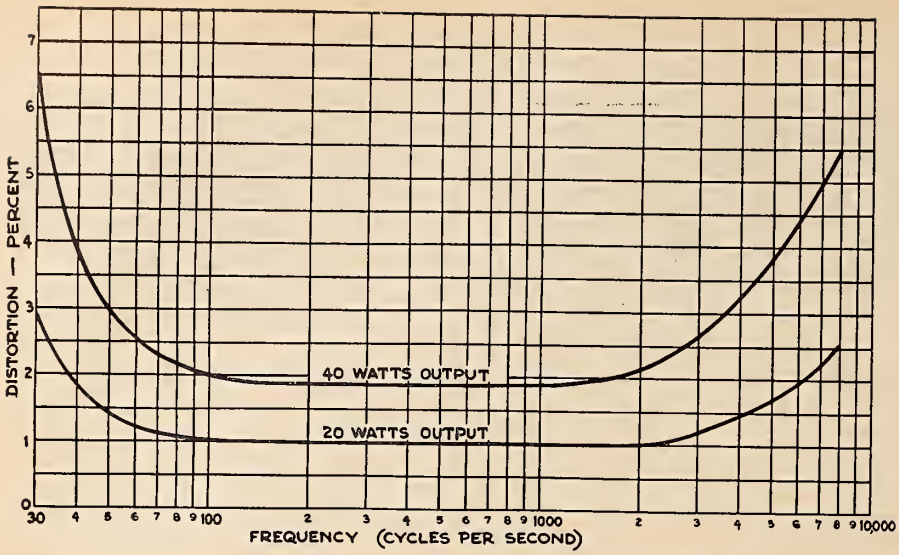


FIGURE 2

basis. If these recommendations are followed, any theatre will be assured of optimum reproduction of all recordings.

A power output rating in itself is meaningless unless qualified by definite statements giving the distortion content at this rated output and the frequency range over which this rating is applicable. The Research Council of the Academy defines undistorted power output by the following statement: "At its rated output, the amplifier shall not generate more than two percent total harmonics in the range from 50 to 5000 cycles per second". These standards are carefully adhered to in the rating of Photophone amplifiers designed to meet Academy specifications.

The aforementioned requirements are necessarily quite exacting. It has been found, however, that for less exacting applications, such as public address or sound reinforcing systems, distortion as high as five or six percent at rated output is often considered tolerable. Therefore, it will be noted that amplifiers on the market for these applications are generally considerably smaller and cheaper than theatre sound amplifiers of the same power output rating. Because of this, care should be taken when selecting an amplifier for sound work to determine the basis of its rating.

Range vs. Distortion

In addition to specifying the total harmonic distortion content, it will be noted that the accepted definition of undistorted power output states the frequency range over which the two percent distortion rating is applicable. This is important because, while an amplifier may give a certain output with less than two percent distortion at one favorable frequency, the distortion content at other frequencies may be considerably more than two percent.

Figure 2 shows the variation in distortion with respect to frequency at a given power output for a typical high grade audio amplifier. It will be noted that the distortion increases at either end of the frequency spectrum. In accordance with the Academy's requirements, the amplifier used for this data is conservatively rated at 25 watts. At this power output the distortion is well below two percent from 50 to 5000 cycles.

It will be noted, however, that the amplifier is capable of delivering 40 watts with less than two percent distortion over the greater part of the audio range. Therefore, if no consideration were given to frequency coverage, this amplifier might have been rated at 40 or even 45 watts with less than two percent distortion, instead of 25 watts.

The increase in distortion at the high and the low frequencies is due largely to the design of the output transformer. It should be noted, that an output transformer which shows no appreciable variation in distortion from 50 to 5000 cycles can only be built at considerably higher cost and great increase in physical size.

Most modern amplifiers for theatre sound reproduction are designed to include inverse or degenerative feedback. This is merely an arrangement to feed some of the output signal from an amplifier back into the input or into some preceding part of the circuit in the proper phase relation to the input signal.

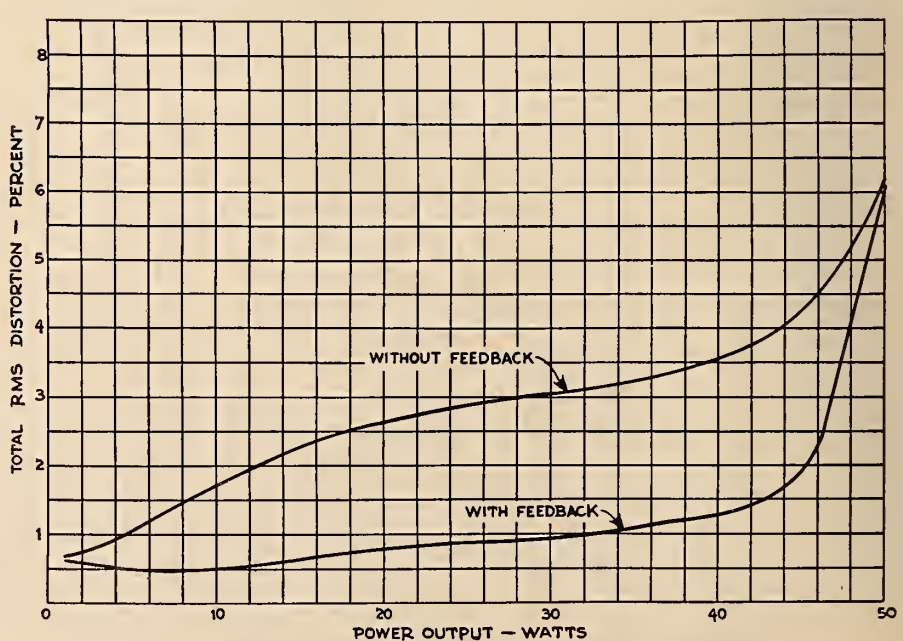
If a distortion component is generated within the amplifier, it is fed back into the input in such a manner that its amplifier value serves to cancel most of the generated distortion in the output signal. Therefore, inverse feedback reduces the distortion present in the output of an implifier within its useful power output range. It does not, as is commonly assumed, increase the maximum power output of the amplifier.

Effect of Feedback

This point is clearly shown in Fig. 3. Without feedback this amplifier can be rated at only 12 watts with less than two percent distortion. It will be noted, however, that this amplifier will deliver almost 48 watts with only five percent distortion. Therefore, when amplifiers of this type are used without inverse feedback and are rated at the power obtainable with two percent distortion, they have considerable additional reserve power with only a nominal increase in distortion.

When feedback is introduced the distortion is reduced to the point where

FIGURE 3



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the same amplifier can be rated at 45 watts with less than two percent distortion. However, if this rating is used, the amplifier will have very little reserve power over and above this rating. If this amplifier were used to replace one that is capable of delivering 45 watts at two percent without feedback, the results might easily be very unsatisfactory because of this difference in reserve power.

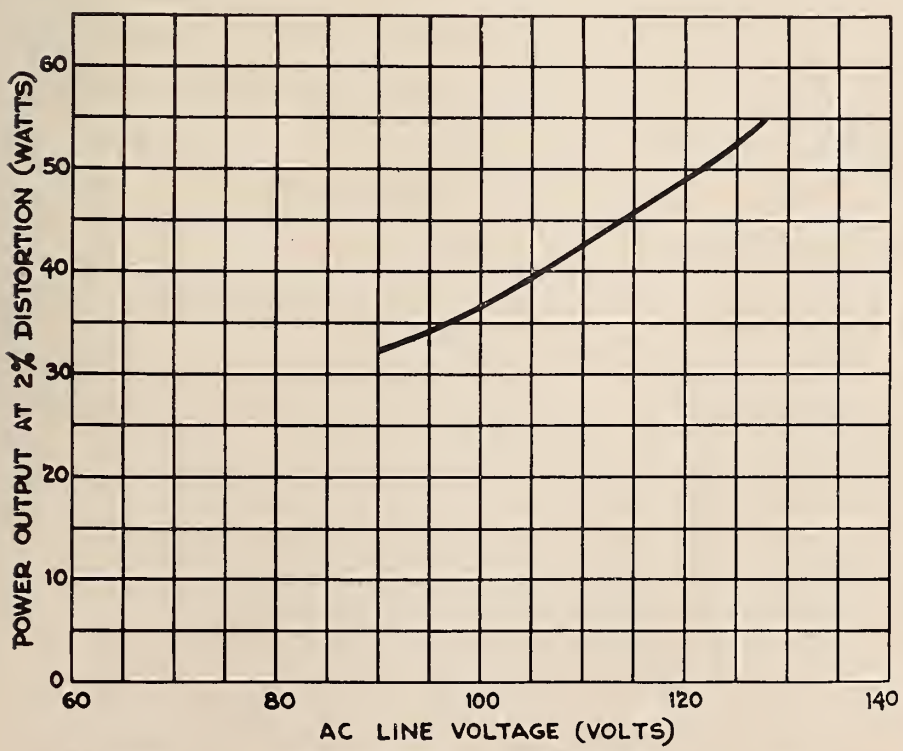
Because of this, RCA engineers have elected to rate the amplifier used for data in Fig. 3 very conservatively at 25 watts to provide margin of reserve power to handle dramatic peaks without distortion. It will be noted that the distortion at 25 watts is less than one percent.

Therefore, in comparing an amplifier with inverse feedback to an amplifier without it, the rated output at two percent distortion does not tell the full story. The exact conditions under which the rating was made on the feedback amplifier should be checked to determine whether or not the amplifier has adequate reserve power comparable to that of the amplifier without feedback.

One further point to be considered in obtaining optimum performance from any given power amplifier is the effect that line voltage variations have on the power output. Fig. 4 shows that for one particular amplifier a line voltage variation from 90 to 102 volts produces a change in the available undistorted power output from 32 to almost 50 watts. To accommodate the wide range of voltage found in various parts of the country the amplifier should be equipped with a tapped power transformer to insure proper operating voltages for the tubes.

In addition to studies on the electrical power rating of amplifiers, sound engineers are now spending considerable time in standardizing methods of measuring loudspeaker efficiency. All the benefits of high amplifier power output are lost if an inefficient loudspeaker system or crossover network is used. Possibly, in the very near future, theatre sound systems will be rated in terms of the undistorted acoustic power output of the loudspeaker system rather than the electrical power output of the system amplifier.

FIGURE 4



S.M.P.E. Papers Program Abstracts

PRODUCTION topics stole the show at the recent S.M.P.E. Convention held in Hollywood, as was to be expected, and were it not for the usual visits to several studios, which are always interesting, there would have been precious little of interest to those active in any other branch of industry endeavor. The RKO Studios, in particular, went all out to provide some eye-filling stuff, and this saved the day, or days, as far as the non-Hollywoodians were concerned.

Quite a few projectionists were in attendance at the meeting, among those noted being Thad Barrows, Warren Jennings, George McDonald, Joe Engle, and H. Morton.

Emery A. Huse, West Coast manager of the motion picture department of Eastman Kodak Co., was elected president of the Society, succeeding E. A. Williford, of National Carbon Co., who continues on the board as past president. Herbert Griffin, of International Projector Corp., was elected executive vice-president, succeeding N. Levinson, of Warner Brothers. The new secretary is P. J. Larsen, consulting engineer of N. Y. City; while Bill Kunzmann was renamed convention vice-president. George Friedl, Jr., of International Projector Corp., is the new treasurer.

The S.M.P.E. Progress Medal was awarded to Walt Disney for his achievement in developing the cartoon movie to its present status. The Society also honored Robert R. McMath of the McMath-Hulbert Observatory of the Univ. of Michigan with its *Journal* Award for the most outstanding paper published in the *Journal* during the year. Entitled "The Surface of the Nearest Star," McMath's paper described his successful experiments in taking moving picture of the surface of the sun.

The Electron Microscope

The outstanding job at the Convention was done by Dr. Vladimer K. Zworykin, famed RCA Director of Electronic Research, who described the electron microscope developed under his direction. He explained that objects heretofore invisible because they were tinier than the wave-length of light, became easily visible when electrons were substituted for light and magnetic fields took the place of lenses.

"The limitation of the optical microscope is the limitation of light itself," he said. "Pickaxes are fine for grading roads, but you wouldn't trust a dentist who tried to use one to probe a cavity. That's the way it is with light itself when you try to see very small objects. The tool is many times bigger than the subject. By using electrons we get a magnification so excellent that we can enlarge the image still further photographically."

The engineers examined a number

(*Continued on page 26*)

SINGLE FEATURES FLOP

A six weeks' single-feature testpolicy at the Ambassador Theatre, St. Louis, was such a decided flop that it has definitely soured the Fanchon and Marco Circuit on such programs, it was announced recently. Verdict is significant because the Better Films Council of St. Louis, strongly in favor of singles, has been insisting that every theatre owner in the county go on record as to his intention respecting future programming.

Spurred by the desire to bring talking  pictures to an ever higher state of technical perfection,  ERPI and Bell Telephone  Laboratories will continue to work hand in hand  to anticipate and  solve your problems of  tomorrow. In years  ahead, you can depend upon these two organizations to  point the way to still finer apparatus for  recording and reproducing  sound in pictures.

Electrical Research Products Inc.

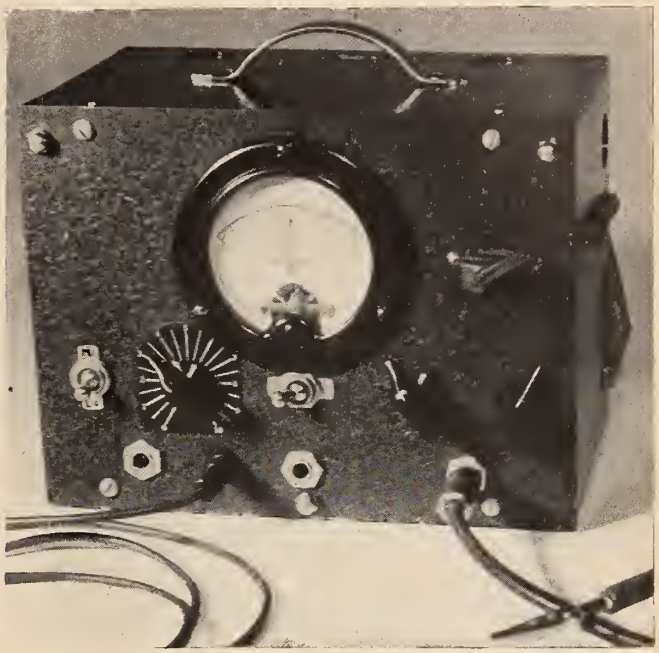
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An Instrument for Trouble-Shooting in Audio Amplifiers

By *CALVIN E. MERVINE*
MEMBER, I. A. LOCAL UNION 218



Exterior view of the Mervine instrument built especially for projection room use. Not shown here is a megohm jack which has been added recently

THE total loss of sound, or the appearance of distortion or hum, during the show is always annoying and embarrassing. The methods used to aid in checking a defective sound system have run the gamut from the lowly battery and buzzer to the cathode-ray oscilloscope. Doubtless, each method has its own particular advantage; but after all the methods have been exploited, there still remains one that can be used on any sound system. This method is built around the basic function of all audio amplifiers.

The basic function of all audio amplifiers is to build up any audio signal that is applied to the input of the amplifier. Each stage of the amplifier will increase the intensity of the signal applied to the grid by a certain definite amount.

The estimation of the gain of each stage or all stages depends upon many complex factors, all of which must be considered by the designing engineer. We are not interested in the manner in which the designing engineer computes the gain, but we are interested in the fact that under normal circumstances a certain gain may be anticipated from a certain stage or series of stages.

This gain is a constant value so long as the amplifier stage is normal. Any variation from normal will affect the gain in some manner. The variation may show up as a weakened signal, a distorted signal, or possibly no signal at all. The defect causing loss of signal is usually easier to find and remedy than is the removal of the cause for distorted signals. Persistent cases of distortion call for skill and resourcefulness.

Some Testing Difficulties

Certain types of projection equipment are difficult to service when special tools or instruments are not at the disposal of the projectionist. The W. E. 211 reproducer set that works into the 753-B control cabinet *via* a 50-ohm line is a good example. The diagram shown in Fig. 1 has been marked with letters so as to identify the points under discussion.

The extreme low level of the signal at the points marked *A-B-C-D-E-F-G* prohibits the use of a headset in checking. The fact that it is possible to get a sound from the room monitor or the stage horns when point *A* is touched with the finger is not a sign that all is well. The quality or the quantity of sound when speech and music are being reproduced may not be acceptable. If the projectionist were able to test at all the points mentioned previously without killing the sound, his work would be made easier when trouble occurred.

The output level of the modern microphone is usually very low. The level is between —50 and —70 decibels, which fact makes the testing of the microphone a difficult task. Some easy method should be available to the projectionist to enable him to test any low level microphone under his supervision.

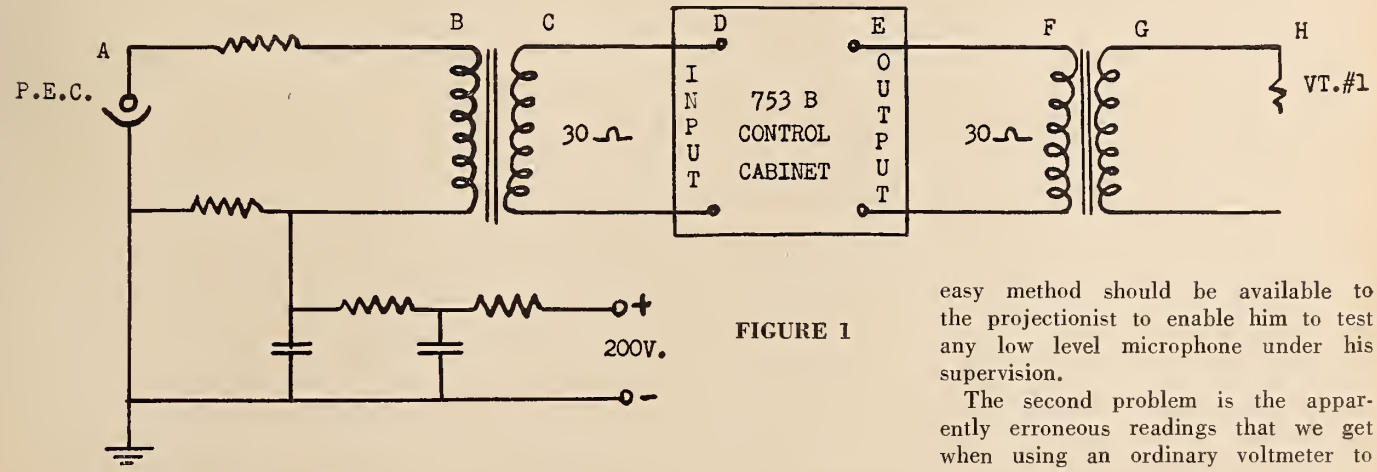


FIGURE 1

The second problem is the apparently erroneous readings that we get when using an ordinary voltmeter to

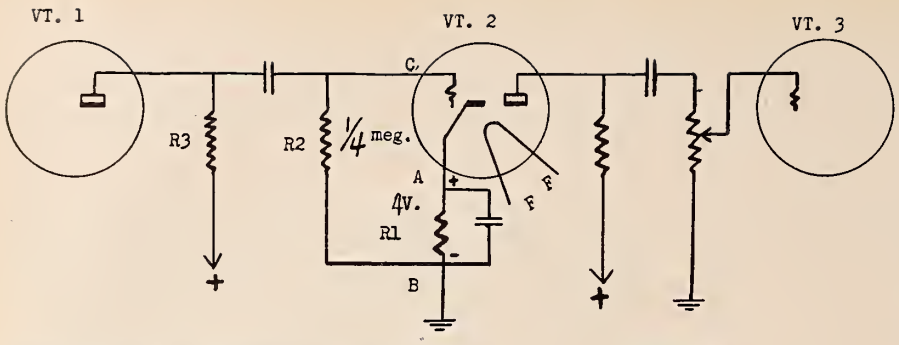


FIGURE 2

measure the p.e.c. voltage at the cell. Another unusual reading occurs when an attempt is made to ascertain the presence or absence of bias potential at the control grid of a vacuum tube. If the grid is returned to the filament or cathode, through a high resistance, as illustrated in Fig. 2, then the reading obtained may be very misleading.

In Fig. 2 the resistor R1 supplies the proper bias for the tube. This bias voltage is easily read across R1 between points A and B. Assume the voltage as read to be 4 volts, with the polarity as shown. The grid of the tube is returned through the resistor R2 to point B, which establishes the point C with a bias of 4 volts negative with respect to point A.

An attempt to read the bias at the control grid is sometimes made, and the results seem to indicate that R2 is open-circuited, since the measured voltage is usually zero. There are other places that proper readings cannot be obtained because of the insensitivity of the measuring device being used. The failure to realize this fact may lead a man to condemn parts that are in no way defective.

Probably falling under problem number two is the one faced by the projectionist who may be called upon to service a direct-coupled audio amplifier. This type amplifier is coming into greater use each day. These amplifiers have no coupling unit between the plate of one tube and the grid of the succeeding tube. This means that if the plate of the first tube is above ground by 100 volts, then the grid of the next tube is also above ground by 100 volts. The loading caused by the ordinary test meter will throw the entire voltage distribution out of normal.

Improved Testing Equipment

Public address equipment will be encountered using the Mallory bias cell. These cells are used to supply the necessary negative bias for the grid of the first audio stage. The cells come in two voltage values, 1.4 and 1 volt. They are often connected in series to obtain enough bias voltage to insure proper operation of the amplifier. The use of the ordinary voltmeter to check the condition of these cells will ruin them.[1]

From the problems as presented, it is plain that the projectionist should have a better means to read voltages in high-resistance networks. These problems may be solved by the use of a vacuum tube voltmeter for the reading of the various voltages encountered. The possession of a high-gain preamplifier for the building up of weak signals will simplify the checking of low signals at their source. The block diagram of Fig. 3 shows a method of approach to all the problems previously mentioned.

There is no device available in the service field that is really suitable for use in the projection room unless the instrument undergoes alterations. The various devices for sale include a wattmeter and one or two tuned radio frequency vacuum tube voltmeters other than the units shown in the block diagram. It is not practical to buy a multi-purpose instrument and then have use for just a small portion of the instrument. The obvious course left is to construct a device that is specifically designed to aid the projectionist. After looking over a lot of data on the subject, I decided that the block diagram covered the subject of trouble-shooting rather well for the projectionist.

Analysis of the block diagram shows that there is nothing unfamiliar about the instrument. First we note an attenuator network section used to prevent overloading the input of the amplifier section. The audio amplifier section is composed of two stages, resistance-coupled. Its output can be fed to a headset or into the diode rectifier section shown.

The diode rectifier operates as a half-wave rectifier. When an audio signal is applied to its input, it will supply a d.c. voltage across its output. This rectified voltage may be applied to the input of the vacuum tube voltmeter. This is a negative voltage and will actuate the meter in a negative direction. The readings obtained may be used to measured relative gain.

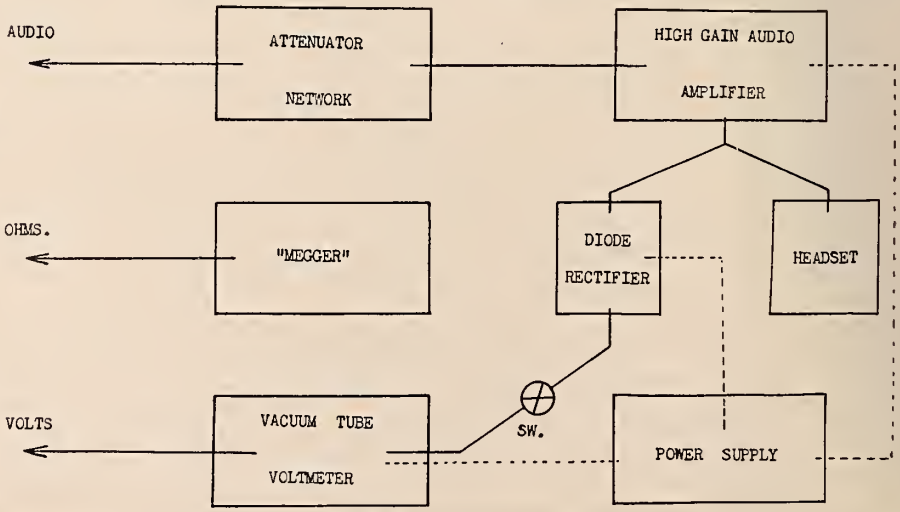
The VTVM is the next section in the diagram and deserves a little explanation. The meter has four voltage ranges 0-5, 0-25, 0-100 and 0-500, and higher ranges can be added if needed. The meter itself is a 0 to 1 milliammeter and will stand rougher treatment than a microammeter. Zero setting of the meter is at the exact midpoint of the scale and represents zero voltage. A positive voltage applied to the VTVM will swing the needle from zero center towards the right end of the scale. Application of a negative voltage will swing the needle from the center towards the left end of the scale.

It is not necessary to reverse the probes when checking voltages of positive and negative polarities as is customary with the ordinary voltmeter. The 0-5 volt scale has a sensitivity of 2 megohms per volt and the input resistance is 10 megohms. The scale is nearly linear in both directions and is easily read.

The power supply is the next unit

[1]Mallory-Yaxley Encyclopedia.

FIGURE 3



Projectionists Acclaim

THE NEW AND REVOLUTIONARY PROCESS THAT EFFECTS A

20% Saving on Carbons!

No Drilling—No Extra Work—No Dirt

More than 600 Mid-West circuit theatres—including Balaban & Katz and Minnesota Amusement Co.—have been using Droll Patented Process carbons for 2 years—with complete satisfaction.

THE Droll Carbon Process is the first such to win complete acceptance by both projectionist and exhibitor—the former because it is the only such process to render absolute safety and satisfaction without requiring any extra work; the latter because it positively saves a minimum of 20% of his carbon bill.

Droll Patented Process carbons are now available to users of the following carbon trims:

SUPREX CARBON TRIMS

Negatives	*Positives*
6 mm. x 9	6 mm. x 12
6.5 mm. x 9	7 mm. x 12
7 mm. x 9	8 mm. x 12

AND the 13.6 mm. x 22 High-Intensity, machined for adapters only.

By the Droll Process, a carbon is so drilled on one end as to make a female opening; the other end is drilled for a male opening. The projectionist need only join the carbons together and clip them with a metal sleeve of pure copper —the same as the outside jacket of the carbon.

ALL DROLL PROCESS CARBONS REACH THE PROJECTION ROOM FULLY PREPARED AND READY FOR USE.

When the positive carbon is about 3 or 4 inches long, you simply insert the next carbon in the milled-out part, slipping the copper sleeve over the stub. This copper sleeve matches exactly the copper coating on the carbon. That's all there is to it—simplicity itself.

So pronounced has been the success enjoyed by this sensational new process that we invite all projectionists to try this type carbon. It will convince you of its absolute efficiency, ease of handling—plus at least a 20% saving. Write us today.

DROLL THEATRE SUPPLY CO.

Division of J. W. DROLL COMPANY

GUS ANDERS, MANAGER

351 East Ohio St. Chicago, Ill.

and a very important section of the instrument. This supply must be made hum-free if possible, so that the pre-amplifier will operate with a low hum level.

The section marked "megger," easily built and easy to calibrate, is used to measure high values of resistance. The range is from 1 megohm to about 30 megohms. The measurement of resistance under 1 megohm is not practical with the "megger," although a regular ohmmeter could be built into the instrument. This addition will make construction much more difficult and complicated.

The final wiring diagram of the instrument is shown in Fig. 4. There will be changes made from time to time as new ideas develop. Probably the average builder will make several changes of his own. A few words of caution to the builder are in order. First, do not think this is a "junk box" gadget. Use the very best parts that you can obtain. Test each part for proper operation prior to installing. Guard against cold or rosin joints when soldering.

Location of Parts

The physical location of the parts is a matter of choice with the individual, but be sure to keep the a.c. as far away from the pre-amplifier wiring as possible. The most difficult thing to obtain is a low hum level. This is due to lack of space that is found in the average small cabinet. A steel cabinet should be used to reduce hum pick-up. A low hum level must be obtained by the builder, or it will be impossible to use the instrument for tracing down hum.

Good quality of reproduction in the pre-amplifier is a goal to be reached at all costs, and is needed to check for distorted audio signals.

The calibration of the vacuum tube voltmeter may be carried out in several ways. A good method is to use batteries as the source of test voltages. Accurate calibration is important so that the readings may be reliable.

The photographs show the location of the panel controls and the manner in which the various tubes and other parts are placed. The bottom row of jacks are as follows: on the left is the audio input jack; next is the audio output jack for the headset. The jack on the right is the voltage input to the VTVM. There are two small banana jacks shown in the bottom row: the one on the left of center is the ground probe jack; that to the right of center is the "megger" jack.

The top row of controls are as follows: at the left is the hi-lo switch used to attenuate the incoming signal. The next control is the audio level adjusting potentiometer. Then we see next the transfer switch used to introduce the rectified audio output voltage into the input circuit of the VTVM. The adjacent control is the potentiometer used to set the meter needle at the exact center of the scale. The extreme right control is the voltage range switch for the VTVM input circuit.

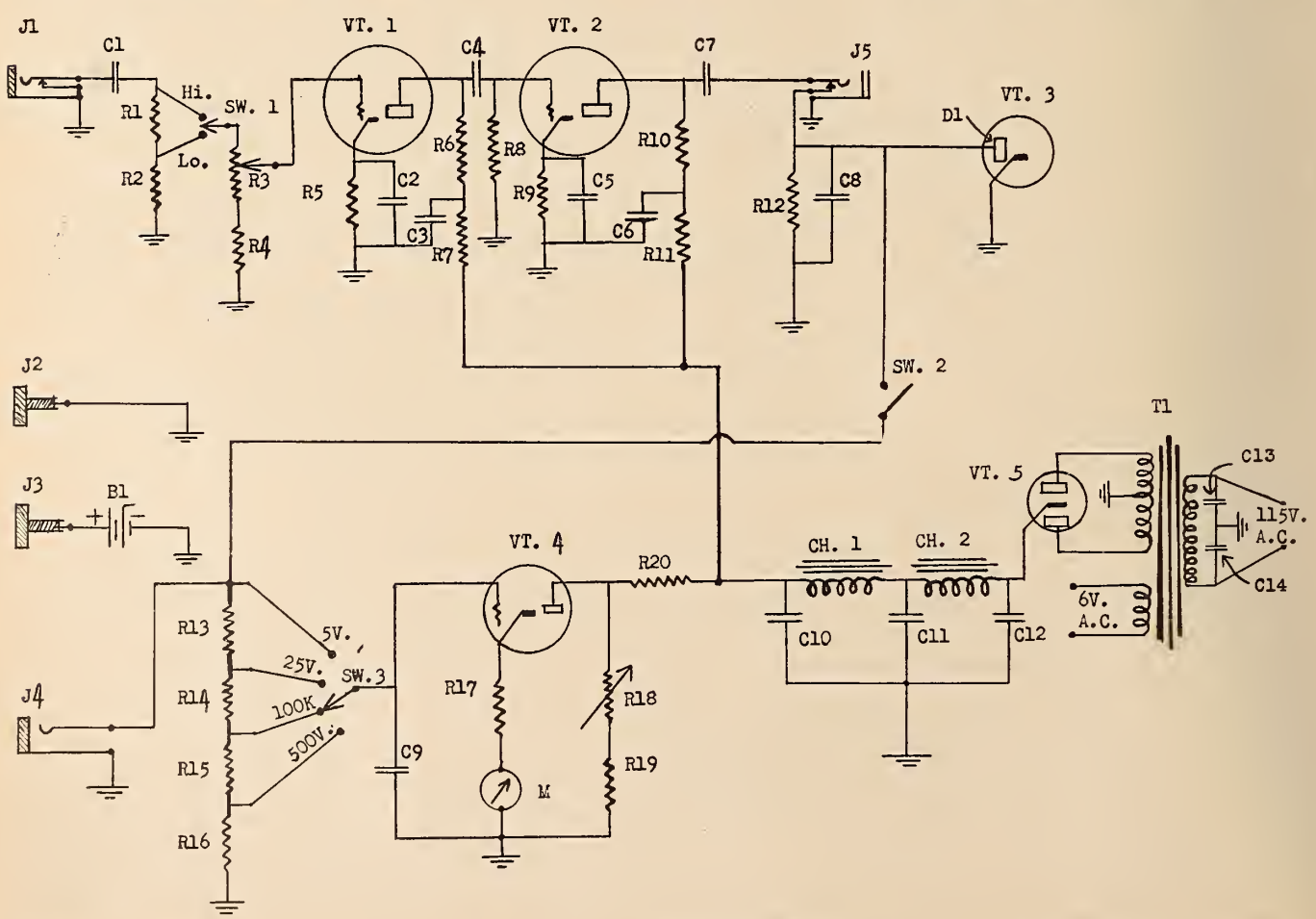
A pair of crystal head phones is recommended for use with the instrument due to their fine quality of reproduction and their extreme sensitivity.

The Assembly Procedure

The VTVM probe and the audio probe are made from rubber-covered microphone cable having a layer of braid shielding. The ground probe lead is ordinary rubber-covered flexible test lead. The probe handles are fibre or other insulating material. The probe handle for the VTVM contains a 1-megohm resistor in series with the probe tip and the microphone cable.

The steel cabinet shown in the photograph is 6 x 8 x 5 inches. This case is really too small for ease of assembly, and I would recommend a larger cabinet. When all parts have

FIGURE 4



been tested for defects, the holes should be drilled for mounting the parts. Mount the power supply parts and all tube sockets. The sockets for the audio tube should be floated on rubber to eliminate any mechanical vibration that may cause the tube to be microphonic in operation.

Wire in the power supply and check the hum level before going any further. The position of the chokes may be altered, if this will reduce the hum level. The filter condensers may be increased in size or the whole unit may be enclosed in a steel shield. The d.c. output from the power supply should be at least 250 volts and may run to 400 volts, as this will give a higher working voltage at the plates of the audio tubes.

The entire audio section should be built with great care. In building this unit be certain that the input is well shielded to prevent hum pick-up. All grid leads are to be run in shielded wire.

The probes are now assembled so that the audio unit may be checked and the level potentiometer calibrated to aid in measuring stage gain. The use of a test loop or an audio oscillator will be of invaluable assistance in the calibration of the level potentiometer.

The resistors chosen for the VTVM input network should be carefully measured and their values must be exact within 1%. This will make calibration much easier than if it is necessary to juggle the values so as to obtain correct voltage readings. The resistors may be mounted directly on the range switch. In soldering the resistors be sure that the flux used does not run in between the contacts of the switch. The presence of dirt or other non insulating material between switch points will cause incorrect readings. The input jack chosen should be one that is well insulated with good quality bakelite. High-resistance leakage across the 10-megohm input must not occur.

The plate and cathode voltages of the tube must be carefully adjusted, and are critical because of their effect on the plate current flowing through the tube.

The completed instrument is turned on and the probes and headset are plugged into their proper jacks. Allow a few minutes for the parts to come up to their proper operating potentials. Ground the instrument with the ground probe and listen to the hum level in the phones. The gain should be wide open for this test. The hum level can often be reduced by reversing the a.c. cord plug. If there is a high a.c. level in the room the audio probe tip should be grounded while the a.c. cord plug is being reversed. You will find that unless you are in a shielded room the probe tip will pick up a great deal of extraneous a.c. hum and will mask your efforts to find the best position for the a.c. cord plug.



Handling the Audio Probe

The audio probe may be used to indicate which side of a line carrying a.c. is "hot." When the probe is applied to the insulation surrounding the "hot" side, the phones will produce a loud a.c. roar; this is not the case when the probe is touched to the neutral or "dead" side of the line.

A word about the method to be used in handling the audio probe is in order. The fader should be set at zero prior to applying the probe on the p.e.c. terminal. In this manner the stage horns will not be affected by the usual loud plop that occurs at the moment of contact. Once the probe is attached there will be no further ill effects and the signal at the p.e.c. can be heard in the headset by advancing the level potentiometer towards maximum. The hi-lo switch must be in the hi position.

The probe may be moved from stage to stage and the signal monitored at at any point desired. The point may be taken that a pair of headphones alone will monitor the signal in some stages. This is true, but the fact that the probe will pick up the signal at the p.e.c. and other points of low signal level is evidence of the superior results that the user of the instrument will obtain.

There will be a point in some stage that the signal heard in the phones will be distorted. This will usually occur in the high level stages of the amplifier. Before passing judgment on the merits of either the amplifier or the instrument, turn the level potentiometer back towards minimum. This will eliminate the overloading caused by excess signal input to the grid of the first audio grid in the instrument. In the event that the signal still is distorted the hi-lo switch must be thrown to the lo position and the level adjusted to the proper setting to give undistorted output in the phones.

The attenuation from hi to lo is 100 to 1 and allows a wide range of signal levels to be checked with the phones. The normal range of a pair of phones is limited by their lack of sensitivity and the fact that they are easily overloaded.

To some, the idea of checking the gain of each stage or stages may seem to be a waste of valuable time. This is true if the sound is easily restored and the show goes on without great delay. A projectionist would indeed be foolish to make gain measurements or even to check tube voltages if the only trouble was a blown fuse or a burned-out vacuum tube. The trouble may not be so simple that it can be repaired at once.

The service engineers have a complete emergency amplifier at their disposal. This is a lifesaver for the harassed projectionist, if the theatre has a service contract. However, a service man may not be immediately available, thus an instrument of this sort is invaluable to projectionists.

Measuring Stage Gain

The measurement of stage gain is a little more involved than the process of going from stage to stage looking for loss of sound, because of the necessity for a more exact technique. The stage by stage gain is not needed unless all other means have failed to clear or localize the trouble. The test takes a little time and must be made with care. The best time to make the first test is when the engineer has made his transmission test and the sound system is at peak condition. The results of this test should be tabulated on paper and filed. This table of gains may some day be the means of clearing a difficult case of trouble.

The general idea of a gain check is simple. The input signal voltage to a stage is measured and then the signal voltage input to the grid of the following stage is measured. The ratio of the second reading to the first reading is the voltage gain of that stage. If the first reading is 5

and the second reading is 25, then the gain of the stage is 25/5, or 5. The gain of the entire amplifier is the product of all individual stage gains.

The test loop is almost a necessity to check gain and should now be threaded in the projector. The headset is removed from the phone jack and the output of the audio section is now being fed into the diode rectifier. The transfer switch is to be thrown to insert the rectified audio voltage into the VTVM input.

The VTVM switch when turned to the 5-volt position will indicate a negative deflection of about 1 volt, with no signal input to the audio section of the instrument. This reading is due to a condition known as "contact potential" and may be ignored.

With the test loop running through the projector and all the sound equipment in its normal operating position, the stage gain test is ready to be made. The results are to be tabulated as mentioned previously. Clip the ground probe to the system ground and apply the audio probe to the p.e.c. terminal. The meter will read a certain negative voltage value. The actual value is unimportant except as a reference. Note the reading on paper. Transfer the probe to the grid of the first audio tube and again note the voltage reading. There is no gain here and there will be a slight loss due to the presence of the p.e.c. coupling condenser.

The probe may now be applied to the plate of the first tube and in this case we should have a definite amount of gain to tabulate. From the plate of the first tube we move to the grid of the second tube. At this grid we will find a gain if the stage is transformer-coupled, while there will be no gain if the stage is resistance-coupled.

The gain of the sound system in its low level stage will not overload the input of the instrument; but as the audio probe is advanced from stage to stage the input will become overloaded and the gain as indicated by the meter readings will become inaccurate. A signal of 1 volt at the grid of the first audio tube is the maximum that should be applied.

To measure the signal where the level is in the order of 40 to 80 volts it is necessary that the input to the instrument be attenuated and that the attenuator be calibrated in some manner. This calibration will give a numerical factor by which the meter readings may be multiplied to obtain the correct reading. This is a very common process used by manufacturers of commercial test equipment.

Tests to locate intermittent sound loss are easily performed by applying the VTVM probe to the plate of the suspected tube and the audio probe then applied to the plate of the same stage. The loss of sound in the phones may be due to the failure of plate voltage and will show up on the VTVM. The VTVM probe may be applied to cathode or the screen grid to check the voltage, while the audio probe is left at the output. This gives a double check that makes the job easier.

Voltage Measurements

The measurement of voltages is carried on in the same manner as would be the case with the ordinary voltmeter. The ground probe is clipped to the system ground of the unit under test. The meter should be adjusted to the exact center of the scale. Handle the positive probe so that the fingers do not touch the metal tip on the probe. Apply the VTVM probe tip to the point at which the voltage is to be measured. If the voltage is negative with respect to ground, the meter needle will swing to the left of center. The application of a positive voltage to the tip will swing the needle to the right of center.

The exercise of a little judgment will prevent the blowing of any fuses if it is found necessary to check voltages in a unit of the so called a.c.-d.c. type. Many times the one side of the a.c. power line is tied to the chassis of the unit. This will place the chassis above the ground by the normal line voltage depending upon the manner in which the a.c. line plug is inserted. Besides blowing fuses, there is a shock hazard that should not be ignored. Be certain how matters stand before going ahead either to check or to handle any a.c.-d.c. unit.

For most voltage measurements, the ground of the instrument is connected directly to the ground of the amplifier under observation, and VTVM probe is then used to make contact at the various points where the voltage is to be read. This process is varied to meet certain conditions which may arise.

In Fig. 2 the grid bias is obtained across R1 due to the flow of plate current through the resistor R1. The instrument should be grounded to the amplifier ground, and the VTVM probe is then placed on the cathode of the tube. This is in accordance with the instructions mentioned previously. The bias may now be read, and if it is of the correct value the ground probe of the instrument should now be moved to the cathode of the tube, and the VTVM probe placed in the control grid of the tube. The voltage read in this second check should coincide with the voltage in the first test made.

If the two readings do not agree within narrow limits, then the fault may lie in the resistor R2. This resistor may have changed in value and should be investigated for defects. The tube may be gassy and the best check is to substitute a tube believed to be

(*Continued on page* 24)

23 Indie Dealers Form 'Protective' Assoc.

TWENTY-THREE independent theatre supply dealers from widely scattered cities through the United States met in Chicago the latter part of October and there organized the Theatre Equipment Dealers Protective Association. Chairman-Secretary of the Association is H. W. Graham of Graham Bros. Theatre Equipment, 546 Lincoln St., Denver, Colo.

Although no official word anent the purpose of the meeting and the aims of the Association was forthcoming from either the organization or its individual members, it is an open secret that independent dealers have been greatly disturbed by the turn of events in the theatre and supply fields over the past year, during which period a radical extension of servicing activities by national service groups has occurred, with one such group now openly offering theatre equipment. Strangely enough, many of the independent dealers in attendance at Chicago, and now members of the new Association, have a working agreement with this national organization covering the sale and installation of sound reproducing and other theatre equipment.

Association dues are understood to be $10 a month per member. A prime objective of the Association, in theory at least, is to offer a solid front of Association members in opposition to any manufacturer, or anybody else for that matter, who does not "play fair" with the independent dealer. Details of just how this ambitious program is to be worked out were not forthcoming.

Of course, it might be set down here that the primary, if not the only, reason for the meeting of the independent dealers in Chicago and their subsequent organization of the aforementioned Association is the fact that they are burning up, red-hot and rarin' to go at RCA, Altec and certain manufacturers who they think will do them no good in the long run. But in the absence of any official word from the Association as to its intentions, we can't set down here any such thing as gospel; and if we did, they undoubtedly would deny each and every word of it. So, what's a fellow going to do?—J. J. F.

Screen Illumination Measurements

By *DR. F. LOEWENBERG*
PHOTOVOLT CORP., N. Y. CITY

DURING recent years theatre owners and managers have become increasingly aware of the importance of adequate screen brightness, particularly in conjunction with color pictures. Suitable measuring instruments are now available to check-up on the efficiency and rate of deterioration of the projection equipment.

Broadly speaking, there are two kinds of measurements which are of interest to the projectionist and the theatre owner: First, the amount of light incident upon the screen; second, the amount of light reflected from the screen. Measuring the incident light furnishes data pertaining to the production system; while the quality and condition of the screen is given by the percentage of reflected light in terms of incident light.

The incident light is measured in foot-candles. The reflected light, or screen brightness, is mostly expressed in foot-lamberts. However, there is no way of measuring the brightness of a surface directly. One has to measure the illumination on a surface opposite the screen and lighted by the reflection from the screen in order to draw any conclusion regarding the screen brightness.

Now, a screen brightness of one foot-lambert will, for all practical purposes, create an illumination of one foot-candle on the search unit of a measuring instrument when the light sensitive surface of the search unit is held close to the screen. That is why a light meter which is calibrated in foot-candles can, at the same time, be used as a foot-lambert meter for brightness,

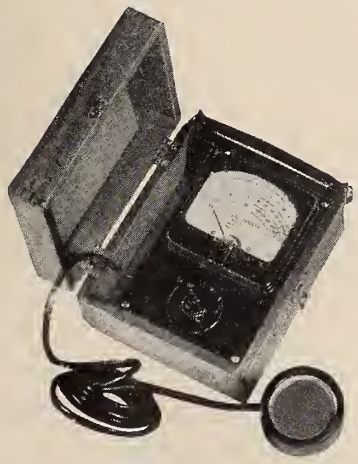


FIGURE 1

provided that the light sensitive surface of the instrument is mounted so as to register light from all directions.

The reflectivity of the screen is obtained by dividing the *incident* foot-candles into the *reflected* foot-candles. If the incident light, for example, is 10 foot-candles and the reflected light 6 foot-candles, the reflectivity of the screen is sixty percent.

A practical measuring instrument is shown in Fig. 1. It consists of a wooden case housing the electrical measuring instrument and the photocell search unit. The latter is connected by a cable and can be held to the place in which the light is to be measured while, at the same time, the instrument proper can be held in any position that is convenient for taking the readings.

Screen Readings Procedure

According to the procedure recommended by the Projection Practice Committee of the S.M.P.E. readings on screens should be taken in nine places to give a complete picture of screen illumination and brightness—at the center of the screen, at the four corners and at the centers of top, bottom and both sides. Such readings can easily be carried out by means of the Photrix Photometer, Fig. 1, whereby the search unit may be fastened to a rod to reach the three upper measuring points of the screen.

By checking illumination and brightness in nine points of the screen, the theatre owner can easily determine whether he receives his money's worth in light from his equipment. Readings taken at regular intervals will clearly indicate any deterioration which has taken place. Such deterioration occurs much too gradually to be perceptible to the eye, which is well known to be a very poor tool for judging absolute light values.

It is understood that, for the incident light readings, the search unit is held in the plane of the screen with the sensitive surface facing the projector. The meter needle, then, indicates screen illumination in foot-candles directly. For measuring the screen brightness, the search unit is turned around to face the screen.

It should be noted that the readings obtained are, within certain limits, independent of the distance from the screen at which the photocell is held. Of course, if the cell is held too close, its shadow and that of the hand may introduce an error. Conversely, if the search unit is held too far from screen, the cell may "see" beyond the illuminated portion of the screen, which, of course, introduces other errors, particularly if measurements are taken near the edge.

The best way to find a suitable distance is to move the cell forward and backward. If this motion does not change the needle indication, it may be assumed that the screen brightness is measured correctly.

Color Correction

Photocells of the type used in photoelectric light meters do not react to colors exactly like the human eye. In fact, they register certain rays which the human eye cannot detect at all. Two light values which the eye would judge as being alike might show up quite differently if measured with a bare photocell. This refers not only to colored light but also to what would be considered as "white" light, the reason being that this light may contain a higher or lower amount of invisible radiation.

To obviate this error, the photocell of the Photrix Photometer is provided with a filter which corrects the color response of the instrument so that it matches the color sensitivity of the human eye. This is of particular im-



FIGURE 2

portance because low-intensity arcs contain more "invisible light" than do high-intensity arcs. A photometer without a correction filter would, therefore, give too high a reading with low-intensity arcs or too low a reading with high-intensity arcs.

The range of the Photometer (Fig. 1) extends from zero to 40 foot-candles. This covers the field of the light measurements described previously, thus any readings of screen illumination and brightness can conveniently be taken with this instrument.

However, there are instances in which it is desirable to measure the screen brightness from a distance to determine the light reflected from the screen into the various parts of the theatre and to test the diffusion characteristics of the screen material in the various directions. For measurements of this kind, the Photrix Photometer is available in two models of higher sensitivity (Figs. 2 and 3), the one having a range of 5 foot-candles, the other a range of 0.5 foot-candle.

Adaptability of Photometer

To obtain such high degrees of sensitivity, these models are equipped with gold wire galvanometers. In addition, the search unit of the most sensitive model consists of two photocells of especially large surface. These latter instruments give clearly readable deflection even at a distance of 100 to 200 feet from the screen. They can be installed with the measuring instrument in the projection room and with the search unit suspended from the ceiling facing the screen but without interfering with the projector light.

If the screen brightness is to be measured directly from the projection room, the sensitivity of even the most sensitive standard model of the Photrix Photometer may not suffice. For this purpose special models are available having search units comprising a lens which concentrates the reflected light from the screen onto the photocell. For permanent installations, the pointer-type galvanometer of the standard model can, furthermore, be replaced by a lamp-and-scale galvanometer of higher sensitivity.

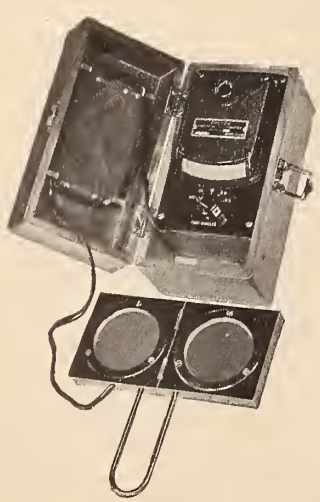


FIGURE 3

It is to be noted that in measurements at a distance from the screen, the foot-candle calibration of the instrument does not give the screen brightness in foot-lamberts. The latter must be calculated from the size of the illuminated portion of the screen and from the distance according to the formula:

$$b = \frac{i \times d^2}{a \times 3.14}$$

in which

b = foot-lamberts

d = distance in feet

i = foot-candles indication of Photometer

a = illuminated area of screen in sq. ft.

If the readings are taken at a distance of 100 feet, if the picture on the screen is 20 feet wide and its area 300 square feet, and if the Photometer reads .1 foot-candle the screen brightness is

$$\frac{.1 \times 100^2}{300 \times 3.14}, \text{ or } 10 \text{ foot-lamberts}$$

It is understood that, for permanent installation, the Photometer can be calibrated to read screen brightness in foot-lamberts directly.

Solving the Mysteries of the Tuberculosis Germ

By *HOWARD W. BLAKESLEE*

[*Once again, as during the past nine years, I. P. is glad to donate this space to the National Tuberculosis Assoc., which through the sale of Christmas Seals, is doing such magnificent work to eradicate tuberculosis.—Ed.*]

TAIL lights are being attached to the tubercle bacillus in the laboratory quest for new weapons to combat tuberculosis. The lights, although gamma rays invisible to the eye, are as real for following a tubercle bacillus through living tissue as the red lights of autos. In fact the tubercle lights are more effective, for they can be detected by sound, which means that they may be followed even when the bacillus has burrowed beyond the view of microscopes.

The tail-light method is simple. From 20 to 40 per cent of the body of a TB germ is composed of fat which contains phosphorus. Phosphorus is one of the 92 chemical elements. When placed in a cyclotron, phosphorus becomes radio-active. That is, its atoms emit the same invisible gamma rays as radium.

Tubercle bacilli, allowed to feed on this radio-active phosphorus, absorb some of the lighted atoms. The phosphorus in their bodies then signals the presence of the germs wherever they may go. These resounding bacilli, inoculated into experimental animals, can be recovered at all stages of the disease. The scientists know that the clincking germs they recover are the same ones that started the experiment.

So, at each step in tuberculosis they can learn precisely what the germ is doing. This knowledge is one of the long sought laboratory secrets of tuberculosis.

For example, it is known that in human tuberculosis the disease succeeds, or fails, according to the ability of the germs to attack the white blood cells known as monocytes. These white cells are numerous in the lungs. TB germs are able to live only if they get inside monocytes. There is always a battle between the bacilli and the white cells. Tracing the germ when he wins, and also when he loses, might conceivably hold the answer to a new, effective remedy.

The tail-light experiments are spectacular. But they are only a small fraction of the laboratory work, and some of the other leads are fully as surprising.

Soil Bacteria Newest Aid

The newest of all is the Relief Army of soil bacteria, now the subject of research at the Rockefeller Institute. Soil teems with bacteria, which produce the chemicals that cause decay of everything organic. The Institute has a large bottle of common earth. A technique has been perfected for placing disease germs in a bit of this soil, and then extracting from the soil bacteria the chemicals they produce to destroy the disease organisms.

Already in the first few months, the soil bacteria have produced powerful chemicals heretofore unknown. Several are enzymes which dissolve the sugar capsule from pneumonia bacilli.

Immediately upon this capsule discovery, search began for soil bacteria enzyme to battle the tubercule bacteria. For many years physicians have guessed that if the wax coat could be dissolved, the body's natural defenses would then destroy the germs.

Difficulty number one has been that whatever harms a tubercle bacillus is likely to be equally bad for a man. The soil bacteria point to a possible solution. For, in the variety of new chemicals from them some have been found that attack germs without being toxic to animal tissues.

The chemical dissection of the

'Fantasia' Technical Data

By *JAMES J. FINN*

WALT DISNEY'S getting ready to come to town again (that is, to New York) and there isn't the slightest doubt that he will also "go to town" with his latest feature length cartoon production "Fantasia". The why and wherefors relative to the technical aspects of this production have been agitating both the general and the trade press to the almost total exclusion of consideration of its artistic implications. It is admitted in all quarters that for two million dollars Disney should come up with really something.

The publicity released anent "Fantasia" thus far is more concealing than revealing, more confusing than clarifying, and might lead the uninitiated to believe the characters walk right down off the screen into the aisles. Don't believe a word of it.

The entire musical score for "Fantasia" is what is generally termed "classical," although even this fact won't spoil the effect of the Disneyan cartoon characters for the *hoi polloi*. They'll love it because they won't understand it and thus it will be smart to "adore" it.

Record Ten Sound Tracks

First, Disney dispatched a sound crew East to record the output of the Philadelphia Orchestra under the direction of Leopold Stokowski in the fine acoustical setting of the Academy of Music there. Get this: eight separate sound tracks for different sections of the orchestra were made, while a ninth mike picked up the sound of the orchestra overall. *That's* a recording job, but that's not all. A musician sat at something resembling a telegraph key and pressed it on the "downbeat," and this rhythm was recorded on a tenth track which would serve as a key to synchronize music and picture.

Back to Hollywood went the sound tracks to be edited down to three sound tracks and a control track. The latter determines not only the volume and which parts of the orchestra are to be favored over the others but also from which of the loudspeakers the sound is to come. The sound tracks being in readiness, the Disney forces then went to work and drew their pictures to fit the music—just the reverse of their usual procedure.

Now for projection. The publicity boys will tell you that "Fantasia" achieves "three-dimensional" sound—and it probably does under the setup Disney has in mind for its projection. He undoubtedly will want the biggest screen he can squeeze onto the stages of the various theatres into which "Fantasia" will go. That will give him two dimensions—height and width—and then he'll create the illusion of reflected sound from the sides, the back and the dome of the theatre auditorium by spotting loudspeakers there—which is precisely what he intends to do.

Dual Projectors Used

This causes the writer to hark back to Erpi's Stereophonic sound reproduction demonstration, which was very lovely in itself. But it wouldn't mean a thing in the smaller theatre having, say, a 15-foot screen, which type of theatre goes to make up 80% of the total number of theatres in America. And neither will this Disney "Fantasia" idea. It's strictly a class, big-house, main-stem proposition that will have to be shown under roadshow conditions and at high prices. Incidentally, Disney himself is authority for the statement that "Fantasia" will be shown only in the 78 largest cities in America.

All of which effectively dispose of the press-agent bleat that within a few years all leading theatres, in order to show "this new type of screen entertainment, will have to be equipped with this new type of sound equipment".

"Fantasia" requires certain changes in the projection equipment set-up. The picture and its accompanying sound will be run on different projectors, and word has seeped out that RCA has constructed 12 such units at a cost of $30,000 apiece. Of course, such equipment for running picture and sound tracks on separate projectors has been available for years, and has long been utilized on the West Coast for studio previews. However, if Disney and RCA want special units, that's all right with us.

There remains unanswered only one question. Will "Fantasia" be what this business terms "box-office"? We would unhesitatingly say "certainly," because Disney has a record of achievement behind him, he is getting roadshow prices for his merchandise, and everybody who is anybody will want to take a peek at "Fantasia" if only out of curiosity and despite and possible written or spoken adverse criticism.

As for the Disney-RCA version of three-dimensional sound, we shall have to wait until we see what we shall see, until we hear what we shall hear—bearing always in mind, however, the physical limitations of theatre auditoriums and average screen size throughout the American theatre field.

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tubercle bacillus at Yale has turned up amazing facts. About 100 different chemical compounds have been extracted from the bodies of these germs. The end is not in sight. There may be 400 different compounds in the body of a single tubercle bacillus.

That fact alone explains sufficiently why it is difficult to find a remedy. More than 10 years' work have gone into this one piece of laboratory research. Some of the tubercle compounds are new to chemistry. With those already extracted it is possible to produce in animals about half of the symptoms of the disease. If the other half are found, it will mean that science can produce tuberculosis without the presence of a single tubercle bacillus. Before that comes to pass, this one line of research should have discovered the clue to a remedy.

Variety of New Approaches

The variety of new attacks in the laboratory is spreading rapidly, due to the discoveries in other fields of medicine and of science. Sulfanilamide preparations have been tried with interesting effects. Chemists are making scores of new forms of this drug every year. What is going on in sulfanilamide is a symbol of the speeding up of the laboratory facilities in all lines of attack on tuberculosis.

The new tools are just getting under way. One is The Svedberg's ultra-centrifuge, whose artificial and magnified gravitational pull can separate and collect every particle of different mass forming the body of a TB germ. The other is the electrophoresis tube, in which a mild electrical force accomplishes a similar separation.

There are many world-famous persons among these laboratory workers in tuberculosis. In the laboratory attack on tuberculosis, although the workers may lose every battle, they are bound to win the war.

And making possible this laboratory campaign against the TB germ are the hundreds of thousands of men, women and children throughout the country who, by their purchase of Christmas Seals, help to finance the medical research program of the National Tuberculosis Association.

—Buy Christmas Seals—

NEW RCA RECORD PLAYER

A new record player especially designed for theatre use has been introduced by RCA. Housed in an all-metal and fire-

proof cabinet having underwriters' approval, this record player has a self-starting synchronous type motor, with speed variations and mechanical vibrations reduced to a minimum through the use of a cushion rim-driven turntable.

A mechanical pickup permits uniform operation over wide variations in temperature and humidity. Special compensation is provided in the pickup circuit. Output is easily maintained at the same level as that of the sound head by means of a built-in volume control. Separate low- and high-impedance output terminals enable easy matching to various types of theatre amplifier input circuits.

The unit is 9" high, 16⅛" wide, 12¼" deep, and weighs 25 pounds.

BETTER WIRE NETWORKS FOR PROGRAM TRANSMISSION

Recent discussions of the use of frequency-modulation broadcasting stations have in some cases included statements that inter-city program transmission networks provided by the telephone companies are not capable of transmitting the tonal richness which will distinguish f.-m. from present-day broadcasting. It may be that such statements result from the fact that the principal broadcasting organizations now use inter-city networks which transmit programs from about 100 to 5,000 cycles; while the frequency-modulation broadcasters, in recognition of the ability of most people to hear frequencies substantially above 5,000 cycles, have been talking in terms of 50 to 15,000 cycles.

Under listening conditions normally encountered in homes and at other points where broadcasting receivers are generally operated, comparatively little is gained from the standpoint of program appreciation by the transmission of frequencies above 7,000 or 8,000 cycles, since it is difficult for most listeners, under such conditions, to appreciate the presence of higher frequencies. Furthermore, most present-day receivers do not respond to audio frequencies above about 5,000 cycles.

The telephone company has given to the principal broadcasting companies demonstrations of program transmission channels capable of handling a frequency band width some 60% greater than the 5,000 cycles now ordinarily employed. These demonstrations have been made over circuits as long as 2,000 miles and the broadcasters have been assured that the Bell System is prepared to provide facilities for transmitting this wider band if and when needed.

ORIENTAL N. G. AURALLY BUT PLENTY SMART WITH PEN

Miles Goldrick, Erpi assistant general foreign manager reports that the following epistle was received from an Oriental customer who was a bit short on his payment for a W. E. audiphone:

"Many thanks for your kind letter of the 24th Inst. In reply I beg apology for words which displeased and offended you. As I am exceedingly poor I never had before invested so large a sum in my life and as such I was between fear and doubt because I had pawned up my entire ancestral home simply on your assurance. Now I have been quite confident of your writing and hope that I will never be put into a loss of money or house by you.

"From your celestial and pious spirit I still fervently hope you would not mind the deficiency of the price but show me mercy by sending me 38A Audiphone or even more powerful than 38A if any, since I know neither 37A nor 38A or any other but you know better. Since I have no other property left to be mortgaged or pawned but I can afford a little more than the price I have already paid for 37A say 4/- or 5/- or so in addition simply on your saying for a very powerful audiphone for my left ear.

"If I still be cast down of your merciful eyes I shall certainly be ruined and be put to loss of postal expenses etc. worth for nothing. Hence I would implore if still more is required in addition to the above proposed, should, you, therefore, for Heaven's sake—pay from your own pocket for God's sake by way of charity and alms but don't miss in giving me ears otherwise I should be totally ruined.

"Do please consider my deplorable condition favourably. God will help you if you will help me. On my part I will repay yours if I be anything better than the present condition which you will know autometically yourself."

Goldrick reports that the Erpi office, from its "celestial and pious spirit," sent the Oriental gentleman his audiphone.

FABIAN RENEWS RCA DEAL

Thirty-one theatres of the Fabian chain, including eight Staten Island, N. Y., theatres not heretofore covered, will receive RCA Sound service under a new contract which also includes parts and tube replacement.

SKOURAS RENEWS ALTEC PACT

Skouras Theatre Corp. has renewed its agreement with Altec for service covering 58 Skouras theatres in the New York metropolitan area. Bert Sanford negotiated for Altec.

Notes From the Service Field

RECENTLY I have been in two theatres where the projectionists have been trying to find out what happened to the picture. They were unable to get a clean focus and the picture appeared yellow on one side. In both of these cases, removing the port glass cleared the condition. In the past two years, I have done this same thing in at least a dozen theatres.

Due to the cost, the average theatre buys plate glass rather than optical glass and therein lies the seat of the trouble. Apparently, this type of glass darkens, due to either heat or light, the change being gradual and over a period of time. In one case, it was impossible to get a clean background on one machine. The lens was blamed. Removing the port glass cleared the condition.

It would be advisable to check the picture with and without the glass and determine if any detrimental effects are taking place, and if so, replace the plate with the proper glass.—Ed Pothier, R.C.A., *Hollywood, Calif.*

When installing tungar type bulbs, or when removing them, grasp the metal base, rather than the glass envelope, to tighten or loosen the bulb in the socket. This will prevent twisting the envelope loose from the base.—J. D. Steely, R.C.A., *Pittsburgh.*

Fuses, particularly heavy current fuses in arc circuits, deteriorate slowly and may blow at currents below rated value. To avoid trouble, it is advisable to service the power panel at regular intervals, cleaning fuse clips and switch blades with fine sandpaper, tightening screws and fuse clips. As a check feel the fuses at the end of the day, after power is off. If they are very warm, it's a danger signal.—W. I. Wall, R.C.A., *N. Y. City.*

A suitable lower takeup adjustment gauge can be made by using an old reel having all spokes removed except one. To this is attached a suitable weight so that the arm stands in about the eight o'clock position with machine running. First machine takeup is adjusted as near as possible with film; then weight is adjusted so that for future checkups it is unnecessary to run film for perfect adjustment. If too tight, arm spins around. If too loose, arm hangs down.—H. E. Bearden, R.C.A., *San Francisco.*

Since the takeup mechanisms have been eliminated as a potential source of flutter in most modern soundheads, there is an inclination to neglect them. They should be completely dis-assembled several times a year, cleaned, and properly adjusted. This should be done at least every time a belt is replaced.

It will often be found that the set screw that fastens one section of the friction clutch to the takeup shaft has worked loose. If the screw gets too loose, the takeup may fail under load and let enough film accumulate in the soundhead to create a fire hazard before the projector can be stopped. Film fires of serious proportions have been caused by this failure.—W. W. Gilreath, R.C.A., *Dallas.*

To facilitate critical focusing of projector on the screen, use the old stunt photographers use of placing a strip of metal or a strip of tape across the face of the lens. This will split the image on the screen, and when focus is in critical adjustment a clear single image results.—F. S. Lakewitz, R.C.A., *N. Y. City.*

When the end of the reel flaps around on the rewind, the tail piece is often torn and damaged This may be relieved by tacking a strip of sponge rubber to the bench under the takeup reel so the film will slap on the rubber and not on the table.—A. A. McCroskey, R.C.A., *Pittsburgh.*

B. & L.'s Americanism Shown By 87-Year Service to U. S.

DEFENDING its 87-year old record on national defense, Bausch & Lomb Optical Co., largest maker of military optical instruments, has issued a book containing laudatory letters from Secretaries Stimson and Knox of the War and Navy Departments. It refutes attacks on the company's loyalty and patriotism engendered by the indictment which charged restraint of trade in military optical instruments.

Although the case was settled in July by common consent, recurrent attacks accusing the company and its officers of Nazi sympathies and ascribing sinister motives have continued, the statement asserts. In the opinion of high military authorities, the company states, the agreement between B. & L. and Zeiss, made in 1921, was beneficial to the armed services of the U. S. "The flow of engineering services was all from Germany" and not from the United States.

The Zeiss relationship had been unsatisfactory since 1933, B. & L. declared, and when war broke out in Europe the American company notified Zeiss that it considered the contract suspended. Since then it has withheld royalties. "The contract has had no effect on deliveries of the Army and Navy, nor has Zeiss ever had a voice in the determination of prices charged the Army and Navy for military optical instruments manufactured by Bausch & Lomb," the statement declared.

Net Loss on War Orders

Denying that the contract had resulted in a monopoly or created exorbitant prices, the company asserted that prices were for the most part of the result of vigorous competitive bidding. "Over a nineteen-year period," said the statement, "our military division has shown a small but actual net loss."

Outlining its services in previous wars, the company said it had broken a foreign monopoly on optical glass during World War I and has persisted in further development of its research and facilities although this material could have been imported at lower costs from abroad.

Asserting that it is wholly American in ownership, management and control, the company said that its record in past emergencies and the enormous obligations it has assumed in the present emergency should be convincing of its entire loyalty to the U. S.

MENCHEN, STUDIO PIONEER, DIES

Joseph L. Menchen, 60, was buried in Hollywood the other day following a heart attack. Notice of his death certainly didn't make the press association wires, and even in the industry trade press the matter was accorded scant attention.

Who was Menchen? Why, he was only the first man to introduce the use of miniatures into motion picture production, a process which saved, and still is saving, the producers many, many millions of dollars. Recently he completed inventing a tracer bullet, liquid fire, and an aerial torpedo fighter which is ready to be turned over to the government.

That's the way it goes.

ALL TESTING TO COAST?

The three remaining major film companies still doing a large amount of screen testing in N. Y. City—M-G-M, 20th-Fox and Paramount—may shortly give up all test work in the East as a result of a squabble with Local 829, Scenic Artists (B. of Painters), which insists upon designating shop stewards without any voice being given to the producers. Union says that threat of Coast move is a bluff intended to win point for producers.

I. A. REMITS SOLDIER DUES

All members of local unions affiliated with the I. A. T. S. E. who enlist or who are drafted into the governmental armed forces will be exempt from dues, will retain their good standing and will have their seniority respected during their tours of active duty, it has been announced officially by the General Office. The I. A.—in fact, the entire A. F. of L.—took similar action in 1917.

AMUSEMENT TAXES SOAR

Admission tax collections for September, responding to not only the new defense levy but generally better business, again showed substantial increase over the previous month and the same month of last year, the Internal Revenue Bureau reported.

The Bureau announced the September collection as $5,851,655.13 compared to $1,852,256.14 for September, 1939, representing a gain of $3,999,398.99. It is also $1,444,557.95 more than the $4,407,097.18 collection for the previous month of August, 1940.

MURTHA RE-ELECTED IN N. Y.

Thomas Murtha, secretary of I. A. Local 4 (Brooklyn stagehands) has been re-elected president of the Central Trades and Labor Council of Greater New York City. Murtha was unopposed.

S. M. P. E. TEST-FILMS

These films have been prepared under the supervision of the Projection Practice Committee of the Society of Motion Picture Engineers, and are designed to be used in theaters, review rooms, exchanges, laboratories, factories, and the like for testing the performance of projectors.

Only complete reels, as described below, are available (no short sections or single frequencies). The prices given include shipping charges to all points within the United States; shipping charges to other countries are additional.

35-Mm. Visual Film

Approximately 500 feet long, consisting of special targets with the aid of which travel-ghost, marginal and radial lens aberrations, definition, picture jump, and film weave may be detected and corrected.

Price $37.50 each.

16-Mm. Sound-Film

Approximately 400 feet long, consisting of recordings of several speaking voices, piano, and orchestra; buzz-track; fixed frequencies for focusing sound optical system; fixed frequencies at constant level, for determining reproducer characteristics, frequency range, flutter, sound-track adjustment, 60- or 96-cycle modulation, etc.

The recorded frequency range of the voice and music extends to 6000 cps.; the constant-amplitude frequencies are in 11 steps from 50 cps. to 6000 cps.

Price $25.00 each.

16-Mm. Visual Film

An optical reduction of the 35-mm. visual test-film, identical as to contents and approximately 400 feet long.

Price $25.00 each.

Address:

SOCIETY OF MOTION PICTURE ENGINEERS

Hotel Pennsylvania New York, N. Y.

INSTRUMENT FOR TROUBLE—SHOOTING ON AMPLIFIERS

(*Continued from page* 18)

in good condition. A leaking coupling condenser will place a positive voltage on the grid of the tube. This is due to the current flowing from the plate supply through R2 to ground. The only alternative is the replacement of the coupling condenser.

The reading of high-resistance values with the "megger" unit is very simple. The ground probe lead is transferred from the ground jack to the "megger" jack. This probe and lead will now be referred to as the "megger" probe. The VTVM range switch is now placed on the 5-volt scale position. The "megger" probe and the VTVM probe are touched together and the voltage reading on the meter represents the zero-ohms setting. This reading is a positive one and has a value of about 2.4 volts when the flashlight cells are fresh. Inserting resistors of various values above 1 megohm will result in a lowered voltage reading on the meter.

The calibration is made by the insertion of resistors whose value is known and the voltage reading produced by each inserted resistor is to be made into a table for reference. This table may be printed on the meter scale with a fine pointed pen, or, better yet, the table may be typed on a piece of card index paper and the card fastened to the front panel of the instrument. A few examples are included to show the relationship between the voltage reading and the resistance value that it represents.

Voltage Reading	*Megohms*
2.4	zero
1.8	4
1.25	8
0.8	20
0.6	30

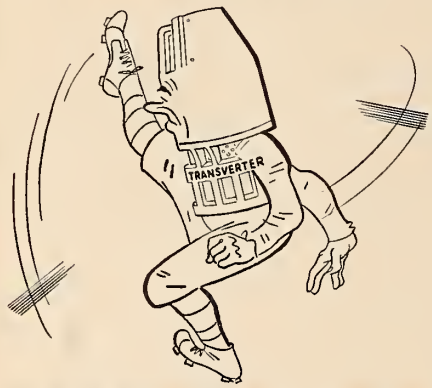
A splendid book is available to those who are interested in this type of servicing for sound equipment. The title is "Servicing by Signal Tracing". This is a fine book on amplifiers, a "must" to the man who builds this instrument as it will show the innumerable tests that may be made therewith.

I suggest that the builder of this instrument use it frequently in order that a high degree of operating skill and speed be developed. Don't throw the instrument around or abuse it and it will give long and useful service.

I will be glad to help the prospective builder in any way that I can. The only thing that I ask is that the inquiry be accompanied by a stamped and self addressed envelope. Perhaps, through the courtesy of I. P., I may be able to answer your questions in this magazine, or else another article, with several photographs, dealing with the construction of such an instrument would be desirable.

I will be glad to quote a price on

TransVerteR



Ask for the new folder on the L V Transverter.

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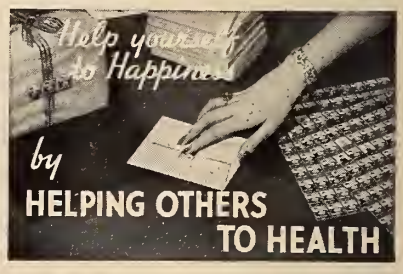
Put him on your team for better screen results.

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This Christmas—be o partner in a greot life-soving campoign. Use plenty of Christmas Seals on your letters and packages. They ore gay, colorful . . . ond what's more impartant . . . they spread a message of Tuberculosis cantrol ond prevention that is vital to the good heolth of us oll!

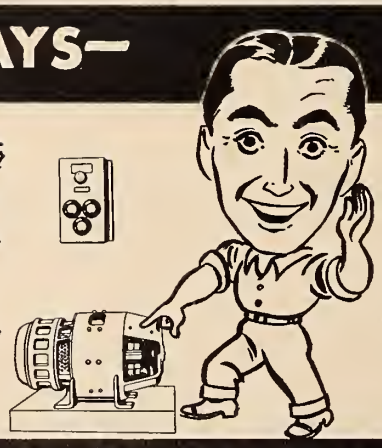
Since 1907, the annual sale of Christmas Seals has done its share in helping ta reduce the death rote fram Tuberculasis by 75%! Complete eradicotion is now in sight! But no one is safe fram Tuberculasis until *everyone* is safe. So help yourself—by helping athers!

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STANDARD EQUIPMENT for BETTER PROJECTION

NATIONAL THEATRE SUPPLY COMPANY

a similar instrument, complete and ready to operate, to those who do not have the time or the workshop facilities at hand to build their own.

[ED's NOTE: The facilities of I. P. are available of course for the purpose mentioned by the author.]

NEW ERPI ELECTRONIC UNIT SPEEDS DEVELOPING PROCESS

"Let one lightning-bug in a swarm of five hundred stage a blackout and the Integrating-Sphere Densitometer can spot him!" That's how Dr. W. J. Albersheim, of ERPI described the precision of the latest optical instrument of show business. Not only does the new device boast a sensitivity five times keener than the human eye but unlike the eye it can tolerate the blinding glare of Hollywood's most powerful sun-arc without impairing its delicate perception in the slightest.

But the engineers who developed the new instrument were not concerned with lightning-bugs nor sun-arcs. They sought a scientific method of measuring the "density" or pattern of light and shade which comprises the image on a motion picture film.

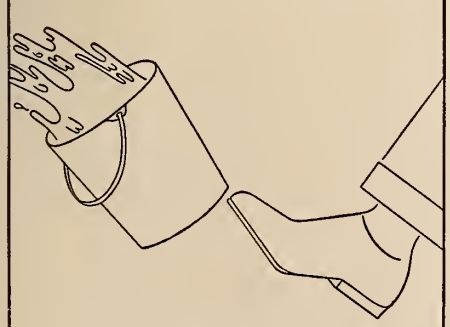
To make such measurements, the Integrating-Sphere Densitometer traps that portion of a beam of light which succeeds in penetrating a test sample of motion picture film. The trap consists of a hollow ball or sphere, the inner surface of which is finished in white, and fitted with a photoelectric cell. Light entering the globular chamber is reflected many times and finally falls on the photoelectric cell as a thoroughly mixed or "integrated" product. Its value or brightness is then translated into electrical current and registers, in terms of density, on a meter.

Greater Accuracy, Much Faster

This information enables technicians to regulate with extreme accuracy the chemical processes involved in developing or "finishing" the film. The device will speed up the finishing operation and materially increase the uniformity of the final product. It functions to indicate the time of development of the film in much the same manner that the camera fan's exposure meter indicates the time of exposure for the film in his camera. The new device, however, is many times more accurate and, moreover, can be used for controlling the development of *both* positive and negative film.

Heretofore, density measurements have

LOW'S KICKED THE BUCKET!



Yes Sir, Ole Man Low Is Dead!



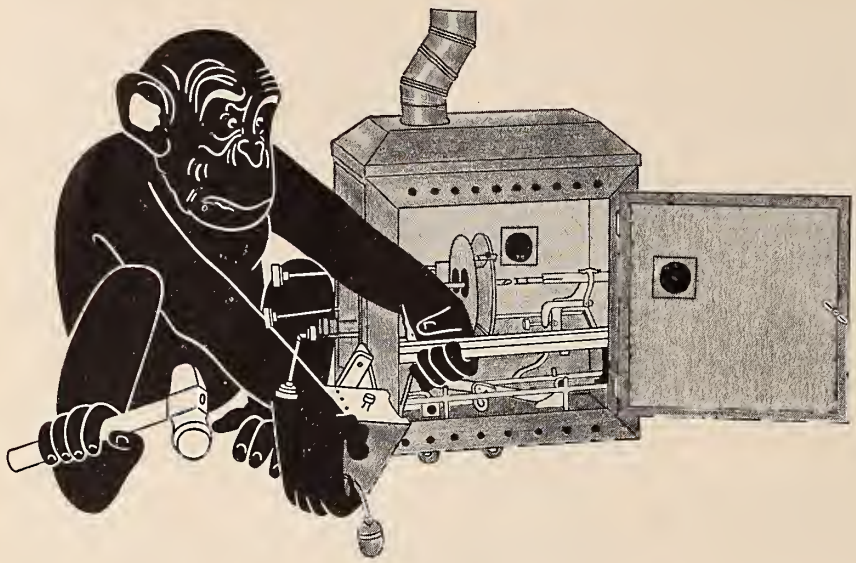
So that the equipment will not let him down

Getting down to fundamentals, the team play that exists between the projectionist and the Altec service man can be put this way: the projectionist, by expert craftsmanship, keeps a complicated set of mechanisms in operation, according to exacting professional standards. On his side, the Altec man must guard against that subtle enemy of all things mechanical —deterioration. Thus guarded, the projectionist can carry out his responsibilities with the practical assurance that, over the long haul, mechanical failure will seldom let him down.

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been taken with an instrument that relied for much of its accuracy on the eye and on the judgment of the individual operator. In this older method, light transmitted through a test sample of film was compared visually with that given off by a standard sample. Fatigue, eye-strain, and individual differences between operators often resulted in error. By eliminating the human element, therefore, the new method gains in speed, accuracy, and consistency.

S.M.P.E. PAPERS ABSTRACTS

(*Continued from page* 11)

of photographs of viruses and other minute objects never seen before. What all this has to do with the present state of the motion picture industry we don't know, but take our word for it that Dr. Zworykin is terrific.

Additional abstracts of papers presented at the Convention and for which there was not sufficient space in our last issue are appended hereto:

STABILITY IN SYNCHRONOUS MOTORS

S. Read, Jr., and E. W. Kellogg
RCA Mfg. Co., Inc.

For the most part, since the advent of talking pictures, motors have been employed whose performance is above reproach. The various types of motor, however, differ widely in their ability to resist load irregularities and in their tendency to oscillate when a disturbance occurs. For the more critical applications these factors deserve careful consideration when the type of design is being selected.

The principal types of synchronous motor are (1) the variable-reluctance or induced-pole motor, (2) the separately excited motor, (3) the ac-dc motor, (4) the hysteresis motor, (5) the low-speed multitooth motor (of the type used for electric clocks), (6) the polyphase, uniform torque modification of number 5, and (7) selsyn motors.

Many of the characteristics of synchronous motors may be best understood by assuming that the polyphase winding produces a uniformly rotating magnetic field, but estimating the stiffness and stability demands a knowledge of the manner in which the ac input varies with mechanical displacement. Generous pole-face grids are essential for stability.

Ac-dc motors have certain elements of



instability as well as stabilizing factors, which are not present in straight synchronous motors. The magnitude of these effects can to some extent be controlled by the external circuit arrangements. Selsyn motors are less readily damped than regular synchronous motors, and for this reason arrangements by which the synchronous motors can be interlocked from standstill are of interest.

BLACK LIGHT FOR THEATRE AUDITORIUMS

H. J. Chanon and F. M. Falge
General Electric Co.

The demand for near-ultraviolet radiation, commonly called "black light," in the production of fluorescent effects has shown the need for a technical approach to the problem. New technics of measurement as well as design information, data on sources and material are necessary to insure most effective use of these new media.

The paper covers design information on the lighting of fluorescent carpet, decorative wall and ceiling murals, and other decorative applications. Information on light-sources, standard filters for absorbing the visible light emitted by the sources, as well as response characteristics of various types of fluorescent materials have been obtained.

The effect of extraneous visible light in masking the brightness of the fluorescent material is discussed. One convenient method of measuring the near-ultraviolet energy from mercury light-sources in existing installations is explained.

ACOUSTIC DESIGN FEATURES OF STUDIO STAGES, MONITOR ROOMS, AND REVIEW ROOMS

D. P. Loye
Electrical Research Products, Inc.

A survey was made of studio experience, as one step in the determination of the most nearly ideal design characteristics practicable for studio stages, review rooms, and other units. Acoustic measurements were also made of Hollywood studio units of these types. These data were correlated with the information obtained in the survey, and used as a valuable guide in the determination of the optimum characteristics and dimensions recommended for major studio scoring stages, monitor rooms, dubbing rooms, review rooms and studio theatres.

These data are described in detail, and recommendations regarding the studio units are given. These recommendations include the optimum reverberation and other acoustic characteristics, and also the most practicable sizes which experience and theoretical considerations indicate to be desirable.

Information regarding Hollywood preview theatres is included in an appendix.

GROUND-NOISE REDUCTION SYSTEMS

E. W. Kellogg
RCA Manufacturing Co.

The principal purpose of the paper is to formulate a statement of the desired characteristics of a ground-noise-reduction system, in terms of such factors as prompt opening, peak reading, and filtering. In this it is assumed that anticipation is not employed. It is desirable to limit the filtering to a single stage of resistance-capacity filtering (or equivalent). Slow closing helps filtering and peak reading. The better the peak reading properties of

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the circuit, and the less the filtering delay, the smaller can the margins be made without causing too frequent clipping.

A number of circuits are discussed which have been proposed for improving the filtering without sacrifice of quick opening, or reasonably rapid closing.

In some operations, anticipation is entirely practical, and if this is done it appears possible to provide an almost perfect envelope current.

EDITING A MOTION PICTURE

I. J. Wilkinson and W. Hamilton
RKO Radio Pictures, Inc.

The paper is an attempt to reduce to words a portion of the mechanical and artistic elements involved in the process of editing a motion picture. The authors realize that they are dealing with a highly controversial subject but feel that, as there is so little pertinent material available on the phase of motion picture production, this paper may serve as a preliminary to a study on a larger scale.

Consideration is given to the origin of film editing and its advancement from the purely mechanical craft of the early days to its present status as a contributing factor in the entertainment and dramatic values of the motion picture of today.

Demonstration film is presented to illustrate various editing technics and to show the possibility of their use as a means of drastically altering original story and dramatic conception.

A METHOD OF CALIBRATING MICROPHONES

F. L. Hopper
Electrical Research Products, Inc.
and
F. F. Romanow
Bell Telephone Laboratories

Methods of determining the performance characteristics of microphones by acoustic measurements are described. Factors involving the accuracy of the methods are discussed. The correlation between a microphone's performance as determined by acoustic measurement and by listening tests is reported. Application of both types of test to a studio type of cardioid microphone are given as an example.

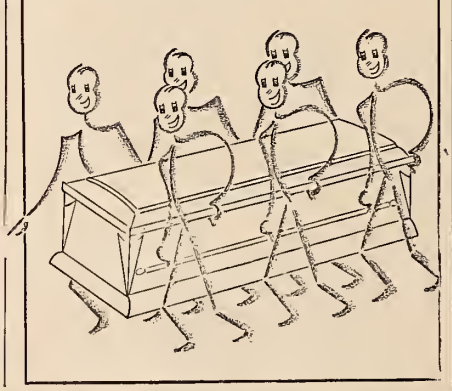
LINE MICROPHONES

H. F. Olson
RCA Manufacturing Co.

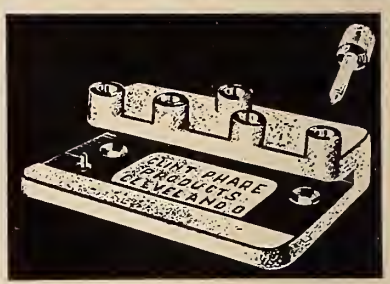
A line microphone is a microphone consisting of a large number of small tubes with the open ends, as pick-up points, equally spaced along a line and the other ends connected by means of a common junction to a transducer element for converting the sound vibrations which converge upon the junction into the corresponding electrical variations.

Several types of line microphones with the useful directivity along the line axis are described as follows: a simple line,

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GENERAL AND DESIGN CONSIDERATIONS OF LOW-NOISE MICROPHONES

A. L. Williams and H. G. Baerwald
The Brush Development Co.

With the development of the microphone art toward increased fidelity, thermal agitation noise becomes the principal limitation and therefore a major problem. Its physical side has been discussed in a recent publication where the factors on which noise performance depends have been analyzed, and a suitable noise rating based on aural perception has been proposed. The purpose of this paper is to outline some practical consequences.

Different microphone types are discussed in regard to their noise performance and, particularly, to their inherent limitations of noise reduction. Multiple piezoelectric microphones which lend themselves particularly well to the design of quiet units, are treated in more detail. The noise performance of different sound-cell types is given including a recent developmental unit which tends to realize the inherent efficiency of the piezoelectric type of microphone to a fuller extent.

The practical realization of the qualities of piezoelectric units in a microphone depends on a suitable choice of the associated circuits and tubes; the principles and limitations of their design are indicated. Application is also made to the design of minimum-noise combinations of different microphone types, particularly to an adjustable-hypercardioid (unidirectional) combination of ribbon and sound-cell type. Some performance data of a corresponding experimental model are given.

SOME FACTORS INFLUENCING VOLUME RANGE IN PHOTOGRAPHIC SOUND RECORDING

W. K. Grimwood and O. Sandvik
Eastman Kodak Co.

This is an extension of an earlier investigation of background noise. The present paper deals more specifically with the relation between volume range and the type of photographic materials and the sensitometric conditions used. A brief study of the effect of the spectral quality of the radiation used in recording and printing is included.

MEASUREMENT OF PHOTOGRAPHIC PRINTING DENSITY

J. G. Frayne
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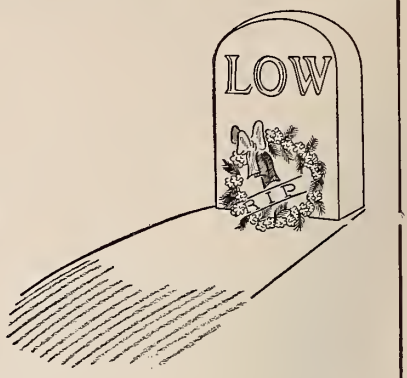
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Of INTERNATIONAL PROJECTIONIST. published monthly at New York, N. Y., for October 1, 1940.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James J. Finn, who, having been duly sworn according to law, deposes and says that he is the Editor of INTERNATIONAL PROJECTIONIST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, James J. Finn Publishing Corp., 580 Fifth Avenue, New York, N. Y.

Editor, James J. Finn, 580 Fifth Avenue, New York, N. Y.

Managing Editor, None.

Business Manager, Ruth Entracht, 580 Fifth Avenue, New York, N. Y.

2. That the owner is:

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JAMES J. FINN, Editor

Sworn to and subscribed before me this 30th day of September, 1940.

(Seal) OTTAVIO GRIMALDI

Notary Public, Queens County Clerk's No. 2714; Queens County Register's 6674. Certificate filed in New York County No. 649; New York County Register's No. 1-G-384. My commission expires March 30, 1941.



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We were discussing the equipment situation with Bob O'Donnell of Texas Interstate on his recent trip to New York. Knowing that importance be attached to this phase of theatre operation. He had a few well-chosen words to say on the subject and we thought them important enough to pass along.

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But to our incessant plugging about keeping your theatre's equipment in dependable condition, may now be added an extra thought and a doggoned important one too.

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Editorial by—"CHICK" LEWIS
Showmen's Trade Review

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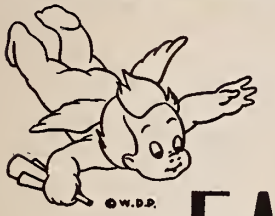
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Edited by James J. Finn

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Monthly Chat

NOW apparent is the fact that the production of "Fantasia" was of much greater significance to the industry in general and the craft in particular than was at first thought. A modified set-up of this joint Disney-RCA development will soon be installed in all Warner theatres, and subsequently will be made available to all theatres under the name of "Vitasound." Thus, still another business stimulant is supplied the industry by the preserving but unsung technicians. Complete details within.

• • •

Our curiosity aroused by the sudden splurge of publicity anent "new" types of screens, we decided to have a look into the situation. Our findings, detailed within, should prove of absorbing interest to the craft. Not a few brickbats in the form of heated disagreement with our stand will be the result of our observations—but even these should prove to be just so much more grist for the mill.

• • •

We can't resist the impulse to inquire occasionally whether the craft wouldn't prefer to have functioning right now an organization such as the Projection Advisory Council, even at 100 times what it cost in money and effort to run that outfit in 1930.

• • •

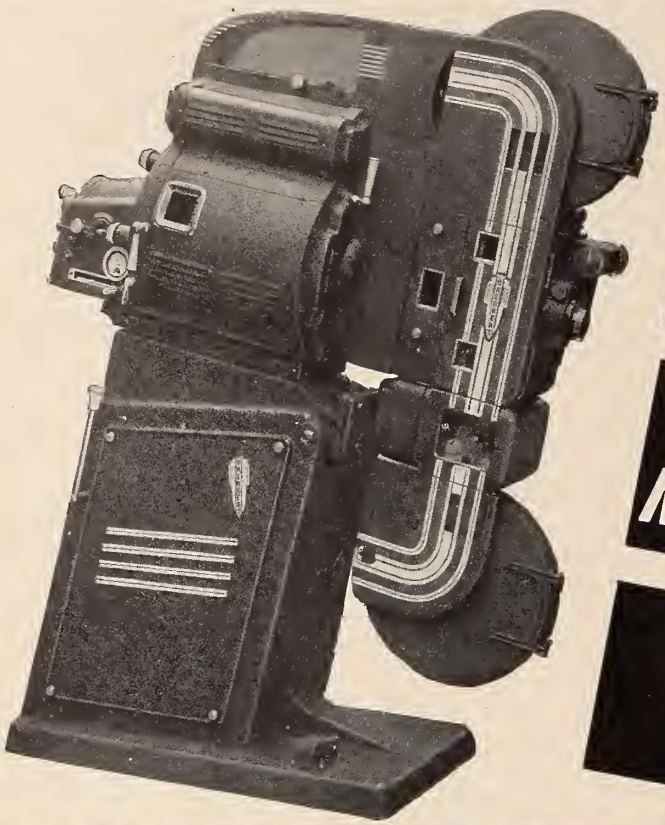
No better proof that I. P. is truly a craft paper is required than the receipt frequently of communications from the female members of Projectionists' families commenting on various topics discussed in these pages. In fact, one of our most valued contributors is the wife of a California projectionist who, *sub rosa*, favors us with her opinions anent I. P.'s content. One of these days we may publish a page of such observations by the feminine contingent — promptly following which the delicate state of our health will render imperative an extended cruise in South American waters.

• • •

The state of flux in which the motion picture equipment supply field now finds itself portends a radical realignment of equipment distribution set-ups shortly after 1941 bows in. That there is more to this situation than meets the eye of the casual onlooker is indicated by the feverish behind-the-scenes activity by various manufacturers and equipment dealers. The projectionist craft has a stake in any new distribution alignment, which fact is ample reason for our sustained interest in the situation.

• • •

Flash! Detroit theatre experiments with modern version of "smellies", that is to say, the process of accompanying certain scenes with appropriate odors. Such redundancy.



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INTERNATIONAL PROJECTIONIST

VOLUME XV NOVEMBER 1940 NUMBER 11

Soundheads On Parade: 1927-40

By *PAUL P. MELROY*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

THE growing pains of early equipments caused many an anxious moment to projectionists, occasioning deep sighs of relief when the power switch was turned off at the end of the show. Tragedies frequently had a touch of humor, such as when an British exhibitor 'phoned the sound equipment distributor during a premier, stating: "Everything is quite all right except when Jolson is making up in his dressing room, the loudspeakers are singing 'Sonny Boy'."

Although film recording ended the out-of-synch. experience, it presented many different problems which were interpreted as wows, flutter, rasp, gurgles, swish, motor-boating, *etc.* Public acceptance of sound pictures demanded the quick elimination of these annoyances. Design engineers immediately focused their attention on the offending unit, which was none other than the heart of the whole sound reproducing equipment—the soundhead, which converted the variations in light transmission of the film sound track into electrical energy.

Constant Film Speed

The purpose of this discussion is to point out the essentials for correct soundhead performance only in respect to film motion; to analyze the causes and effects of irregular film speed; then to follow design changes and learn how the present high-quality results have been finally attained. Many improvements have been made through valuable suggestions from projectionists who have always shown a keen interest in this particular unit.

The first essential requirement in reproducing sound from any type of recording is constant speed of the recorded surface as it passes the sound pickup point. In the light scanning system of a soundhead the film must have an absolutely constant speed at the point where the light beam from the exciter lamp passes through the sound track. The linear speed must be identical with the speed of the recorder that made the track which is 24 frames per second or 90 feet per minute.

The film must travel perpendicularly to the axis of the associated optical system at the scanning point, and the emulsion must always remain at the focal point of the optical system. Finally, the film path must be such that only the sound track area passes through the scanning light beam.

Thus, there are three absolute necessities to control film motion in the light scanner: constant speed of film, surface pressure to hold film in the plane of focus, and lateral guides to prevent side weave. At first thought these requisites appear so simple that little difficulty should be experienced in designing a suitable soundhead; however, a further examination of the many factors which affect even the first requirement, constant speed, will reveal many difficulties which, like parasites, put up a tough fight against extermination.

It has become a universal practice of sound engineers to refer to all variations in film speed, whatsoever the cause or effect, as flutter. This new interpretation differs from early definitions which called slow speed variations "wows", and high-frequency speed variations "flutter". In a very broad sense, a wow was caused by speed variations of the rotating elements either driving or driven by the film; whereas a flutter was caused by minute jerks on the film.

Irregular Film Motion

The motion of a car serves as a good analogy to help visualize this difference. The speed of a car continuously varying between 5 and 10 miles per hour would constitute a low-frequency flutter. The same car at a speed of 5 miles per hour but jerking with each combustion impulse of the motor would constitute a high-frequency flutter. However, for purposes of standardization and to avoid confusion, the term "flutter" will be used to describe all types of speed variation.

It is unnecessary to describe how flutter sounds. A quick and easy demonstration of low-frequency flutter can be made by touching the edge of a phonograph turntable while it is playing your favorite symphony. It is somewhat more difficult to produce a high-frequency flutter, but its existence can be detected quite easily as a raspiness in the reproduction of recordings

of flute or violin instruments and soprano voices.

Among the more common causes of low-frequency flutter are fluctuations in drive motor speed, improper drive belt or chain tensions, poor mechanical condition of projector head, worn shafts, bushings or universal joints, eccentric idler or impedance rollers and sprockets, improper spring tension or pressure in mechanical filters, and flywheels out of balance.

High-frequency flutter may be caused by sprocket teeth, sound gate friction, poor meshing of gear teeth, or tight bearings. Most common is the 96-cycle flutter, resulting in a broken up raspy sound, originating from the 96-sprocket-hole-per-second speed of film. Fortunately, all of these sources of flutter cannot exist in any one soundhead at the same time.

Soundhead Components

A brief practical analysis of the relation of the component parts of a soundhead to constant speed of film may help to clarify some of the above mentioned causes of flutter:

1. Drive motors have rarely been directly guilty of causing irregular film speed. The two early types, the three-phase synchronous and the d. c. motor with vacuum tube speed control circuits, served their purpose well, but difficulties in obtaining three-phase power and the cost and complication of control circuits caused them to be discontinued.

The simplicity of the single-phase induction motor has now made it the universal choice for soundhead drive. Even under wide variation of projector load or power supply voltage, the speed regulation of a well designed induction motor is so good that approximately synchronous soundhead speed is maintained. However, as constant speed of any machine depends on the speed regulation of its prime mover, it is obviously essential that care be exercised in the selection of a high grade soundhead motor.

2. Among the more common drive systems found in use today are belt, chain, universal joint, flexible and direct couplings. These mediums which transfer motion from motor to soundhead have given surprisingly little trouble, except from vibration of the soundhead or undesirable noise in the projection room. A short flexible coupling, with the drive motor suspended in oil resistent synthetic rubber, is now used in modern soundheads, giving a smooth running, vibrationless and quiet drive.

3. Poor mechanical condition of projector may cause slight irregularities to film speed in the soundhead, especially in those equipments where the projector is driven from a point common to the constant speed sprocket. Worn gears, loose bearings, and the 24-cycle jerk of the intermittent movement will reflect a varying load on the main drive gear and thus introduce flutter. Isolation of the constant speed sprocket shaft from the projector drive now found in the latest type soundheads eliminates this possibility.

4. Due to their construction, pressure-type stationary sound gates, both straight and curved, were susceptible to flutter unless very accurately adjusted. The curved type gate was superior to the straight gate because it was more successful in holding the film in the focal plane of the optical system. Warped or buckled film had a tendency to "ride out" in the straight gate and hence go out of focus; whereas when a slight bend was applied, as in the curved gate, the film tended to cling to the gate and remain in focus. Even with the curved stationary gate, however, it was necessary to apply a certain amount of pressure to the film by means of fixed gate shoes. Because of the friction of these gate shoes the film did not flow freely past the scanning beam as it does in modern soundheads, but instead had to be pulled through the gate by the constant speed sprocket. Under these conditions, it is easy to see that any irregularity in the motion of the constant speed sprocket, any eccentricity of this sprocket, or worn or hooked teeth on this sprocket would impart irregularities to the motion of the film past the scanning beam, causing flutter.

Odoriferous 4th Dimension

Future of the film industry is assured after the sensational Detroit debut of Aromatix Co.'s "Dramatic Zephyrs" (vulgarly termed "smellies" by low-brow projection mugs). Following experimental tryouts in smaller houses, process was "synchronized" with presentation of the feature "Boom Town," the many contrasting locales of which permitted full play for the scent experts' talents, who had a field day with odors germane to oil fields, the tropics, Hedy Lamarr's boudoir, business offices, and race tracks. Demands of the latter scenes didn't stump Aromatix engineers.

Week's stand at the Vogue Theatre assertedly was a great success, with comment cards indicating that 80% of the patrons okayed the innovation. No casualties among either the projection or stage crews during the run.

Idea is definitely not new in conception, although Aromatix may have introduced some new angles in its execution, the same stunt having been a pet project of one William Featherstone more than 20 years ago, and, latterly, having been tried out on a small scale at the N. Y. World's Fair.

The addition of various types of mechanical filters to the constant speed sprocket shaft helped materially in isolating film motion from shocks in the motor drive or gear train but it was still necessary to maintain the constant speed sprocket in perfect condition and adjustment to avoid flutter.

Early Stabilizing Adjuncts

5. The viscous damper was probably as successful as any of several mechanical filter devices placed on the constant speed sprocket shaft to stabilize film motion, but it required care in the choice of a lubricant and an adequate warmup period before showtime.

Probably the most effective early device for filtering high-frequency flutter was the impedance roller, located between the pressure gate and constant speed sprocket. This roller, driven by the film, was directly attached to a small flywheel. Exact flywheel balance, a non-eccentric roller and perfect fit of shaft and bushing were essential. Advancements in design have shown that brute force mechanical filters of the single-flywheel type are not necessary if proper attention be given to reduce frictional drag on the film at the scanning point. Flywheels located on drive motor shafts serve a different purpose and should not be confused with the foregoing.

6. The job of the lateral guide roller is to prevent possible side motion of the film. Through a slight pressure on both edges, the film is guided in such a path that only the sound track area passes through the scanning light. Any appreciable lateral deviations from this path result in the reproduction of foreign noises. Side weave toward the operating side produces pickup of picture frame lines (motor boating); side weave away from the operating side produces pickup of sprocket holes (96-cycle hum). The location of this guide must be close to and preceding the light scanning point.

The front guide on the sound track side of the film (operating side) is generally fixed in position. This position is determined by the setting of the lateral adjustment screw. The rear guide is free to move laterally and exerts sufficient pressure on the film edge to hold the film always against the front guide. This whole lateral guide assembly must be so mounted as to permit quick and easy adjustment of its lateral position with respect to the scanning light.

Standards of the industry reserve a film space 100 mils in width for the sound track. As the scanning light beam is only 84 mils long, a film weave of 8 mils from center to either side is possible before getting off the sound

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In the first place we don't have to listen to any noise—these G-E Copper Oxides are quiet as a graveyard at midnight. Not only that—but there isn't any noticeable heat. That fan keeps those units cool as a mint julep. In fact it even improves the general air in the projection booth.

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But that remote control feature tops 'em all. The rectifiers are across the booth, but this switch on the lamp pedestal does the control job. Nothing to it. No jumping around to do.

The boss likes these rectifiers, too, because they've cut his current costs in half. So we're all pretty well satisfied.

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track. Furthermore starting with the film correctly aligned in the scanning light a total weave of 12 mils away from the operating side will pick up sprocket holes, or a total weave of 19 mils toward the operating side will pick up picture frames. In addition to the aforementioned effects of film weave, distorted sound may result if the sound track is not exactly centered in the light beam.

In the foregoing, an attempt has been made to show the necessities for the main components of a soundhead and how these parts individually aid or retard the constant speed of film. It will be interesting to go back to the early days of the first practical soundhead and follow changes made in successive models, to see how components have been shifted around in various combitions—always toward the goal of a more constant film speed. The basic ideas of the pioneers provided a strong foundation on which present day design engineers have fashioned a high quality apparatus.

Soundheads, Past and Present

Among the first film sound reproducers developed in the Schenectady laboratories, under the able guidance of Heisler, Hoxie, and Robinson, was an experimental model particularly interesting because it was located on top of the projector head, thus requiring the respective location of synchronized picture and sound to be in the reverse order from what it is today. A well remembered special demonstration film, John Gilbert in *Flesh and the Devil*, very popular at that time, was recorded in this fashion. While this system had some advantages, it also had several operational disadvantages and hence was discarded for the present system of placing the soundhead below the projector.

A special type of soundhead, which reached small scale production, was mounted neither above nor below the picture head, but on the side—made for that famous Paramount road show *Wings*. It was suspended from the motor bracket dove tail on the side of the Simplex pedestal. Projectionists fortunate enough (?) to have helped in the setting up of this equipment at its many one-night stands did not soon forget that soundhead, requiring, as it did, three men to hoist it into position on the pedestal, let alone getting it up to the projection room in the first place.

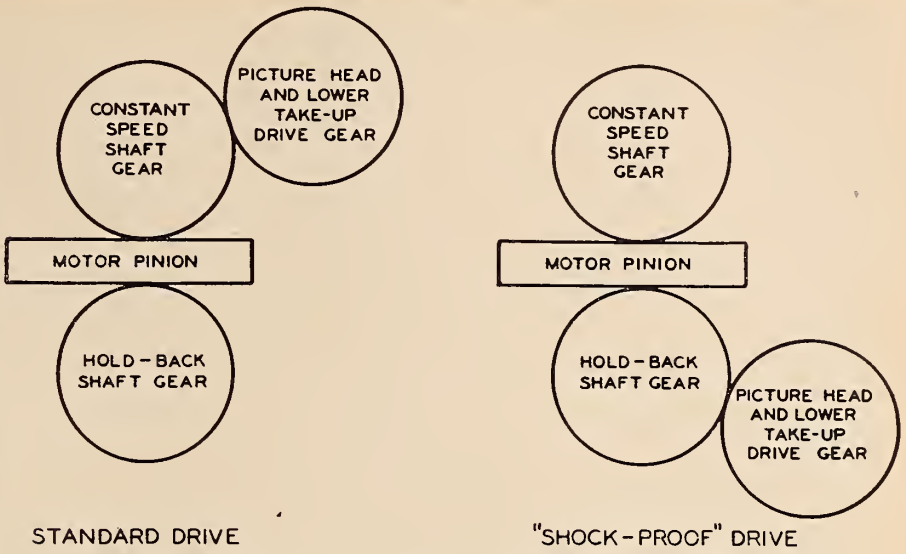


FIGURE 2. *Schematic of 'Standard' and 'Shock-Proof' drives*

The sound and picture films were separate. A huge disc clutch between the two mechanisms provided mechanical coupling to guarantee synchronism of sound and picture. A three-phase motor drove the soundhead, which in turn was coupled to the projector by a shaft and gear assembly. This soundhead used a friction drive on the rim of the sound take-off drum.

The demand of theatres generally for a film-sound reproducer easily attached to existing projection equipment resulted in the first soundhead attached to the projector, reproducing sound from the same film that carried the picture. Its wide distribution makes unnecessary herein a detailed description of its features, as nearly all projectionists have used it. Chain or belt drives were used to couple the reproducer mechanism to a three-phase synchronous, or a single-phase induction, drive motor.

Curved gates were usually used throughout. The superiority of this type has been previously pointed out. The constant speed sprocket was driven through a viscous damper mechanical filter system which, as cited previously, had certain inherent weaknesses.

To eliminate this type of mechanical filter, a film-driven impedance roller was added between the gate and constant-speed sprocket. This was more effective in preventing 96-cycle sprocket flutter but made possible lower frequency flutter if the impedance roller or bearing became worn. The important fact to bear in mind is that throughout all this early period of soundheads flutterless reproduction could be insured only by extreme diligence and very accurate adjustment.

In 1932 the introduction of the now famous Rotary Stabilizer to replace all types of pressure gates effectively eliminated flutter. The Rotary Stabilizer is an ingenious device which filters out slight irregularities in film motion such as may be caused by very small disturbances coming from the gear train or by the sprocket teeth engaging with the film. This unit, since it is the heart of the modern high-grade soundhead, will be described in detail.

The Rotary Stabilizer is attached to the film drum shaft. When the film is pulled around the drum by the constant speed sprocket. the film rotates the drum, which in turn causes the outside shell of the Rotary Stabilizer to rotate. Fig 1 shows a cross-section of the stabilizer.

It should be mentioned that the outside shell is made of very light material so that it will not place undue load on the film when the soundhead is started. Located inside the external housing is a heavy flywheel which is mounted upon a large ball bearing. The clearance between the outside diameter of the flywheel and the inside of the shell is only 0.008 inch.

The Rotary Stabilizer is completely filled with oil so that when the light outer shell rotates it transmits its rota-

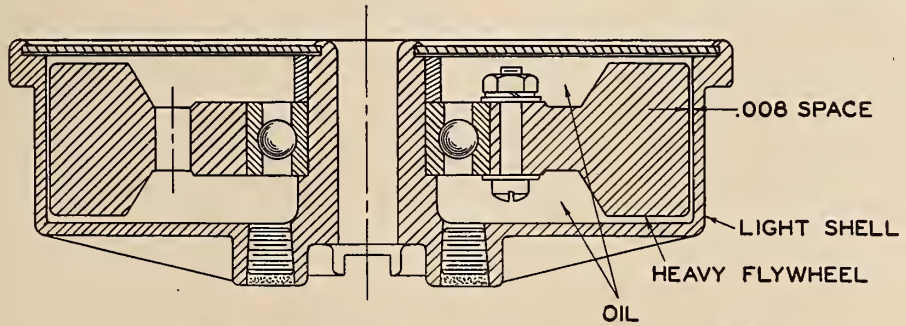


FIGURE 1. *Cross-section of Photophone rotary stabilizer*

tive motion through the thin oil layer to the heavy flywheel. After the flywheel has been brought up to speed, it tends to stabilize and filter out variations in speed of the outer shell.

The film between the projector holdback sprocket and the soundhead constant-speed sprocket is drawn tight and then slackened off two sprocket holes so that the drum floats on a two-hole loop between these sprockets. In this way the rotary stabilizer can filter out minor speed variations caused by meshing gears in the motor drive gear train and sprocket teeth engaging with the film sprocket holes.

The incorporation of this device was accompanied by the adoption of precision ball bearings on all moving parts, pinion drive gears, drive motors mounted in oil-resistant synthetic rubber, and heavy flywheels on drive motor shafts giving a soundhead with extremely low flutter content. At that time (1932-3) it was believed that little more could be done to further improve film motion in commercial reproducers.

Shock Proof Drive System

Persisting in their study, however, design engineers found slight speed irregularities being introduced at the constant speed sprocket due to the varying loads outside of the soundhead assembly. Suitable changes made to protect the constant-speed sprocket from such shock have produced an assembly now recognized by the industry as the Shock Proof Drive System.

This Shock Proof drive, the latest major achievement in film sound reproducers, is incorporated in present production soundheads identified as type MI-9050. The purpose of this design change is to prevent the jerky load of the projector mechanism and the constantly varying load of the lower take-up reel from being transmitted to the constant-speed sprocket shaft. It has been accomplished by rearranging the soundhead gears so that the picture head and lower take-up were not driven by the constant speed shaft gear. Fig 2 illustrates this change diagrammatically.

In the Shock Proof drive the constant-speed shaft is free of all loads except to pull film past the ball-bearing-mounted Rotary Stabilizer. It is driven by a steady running powerful motor with a heavy flywheel. The gear driving the erratic projector load has been isolated by transferring it to the other side of the holdback sprocket gear. Irregular speed shocks cannot feed back to the constant-speed shaft because of special helical gears so designed to retard reverse power.

Wherever possible the gear tooth ratio has been so designed to include a hunting tooth an important feature to prevent slight imperfections of one tooth unduly wearing a spot on its adjacent gear. A one-to-one tooth ratio permits a given tooth to engage the same spot on an adjacent gear during each revolution, with possible introduction of irregular motion after some use. An odd tooth ratio prevents this frequent meshing of the same respective teeth, and, if carefully designed, one tooth on the driver will eventually engage all the teeth of the driven gear and thus insure even wear of all teeth. The hunting-tooth action guarantees uniform wear throughout the whole gear with a resultant smooth motion continuing throughout the gear life.

Actual measurements of film speed variation by a flutter bridge reveals 20% less flutter with the Shock Proof drive than with any other type soundhead available today. Fig. 3 shows a closeup photograph of the gear train employed in the Shock Proof drive.

In conclusion, this parade of soundheads has revealed consecutive design changes each of which has contributed to a smoother and more constant film speed at the scanning point. Present accomplishments have reached a degree of perfection which will be difficult to surpass. However, research engineers never stop in their quest for improvements towards greater enjoyment of sound motion pictures.

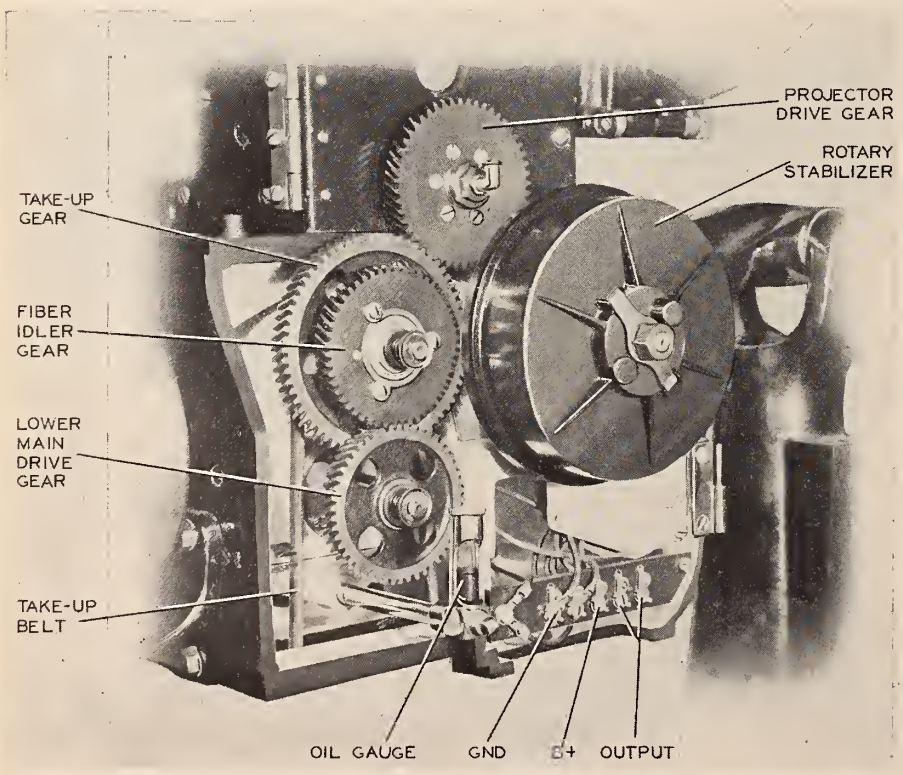


FIGURE 3. *Gear Train for RCA Photophone 'Shock-Proof' Drive*

Air Bubbles In Lenses No Indication of Inferiority

Tiny air-bubbles in the glass of a photographic lens are by no means an indication of inferior quality. These bubbles are almost inevitable in any piece of fine optical glass sufficiently large to be used for making an element of a photographic lens. In a lens of high quality they are few, but it is almost impossible to eliminate them entirely. However, their effect upon the quality of the lens is generally negligible.

How negligible may be seen by the following example: Assume an f:4.5 lens of 6-inch focus, with a diameter (at the front glass surface) of 32mm. Assume, too, a dozen bubbles (more than usual!) in the various glass elements, each bubble averaging 0.1mm. in diameter.

Only Slight Light Interference

The lens-surface will have a total area of 804 square millimeters. The total area of the bubbles will be 0.0942 sq. mm. Thus, out of the whole area of the lens, approximately 1/8700th part will be rendered less effective by the interference of the light passing through the bubbles.

About 1/8700th of the total light passing through the lens may be diverted from the film. If the lens is stopped down, this ratio may be increased, but in most cases the number of bubbles affecting the lens-action will also be reduced. Either way, the effect of the bubbles may be considered negligible in practice.

SEE FILM B. O. UPSWING

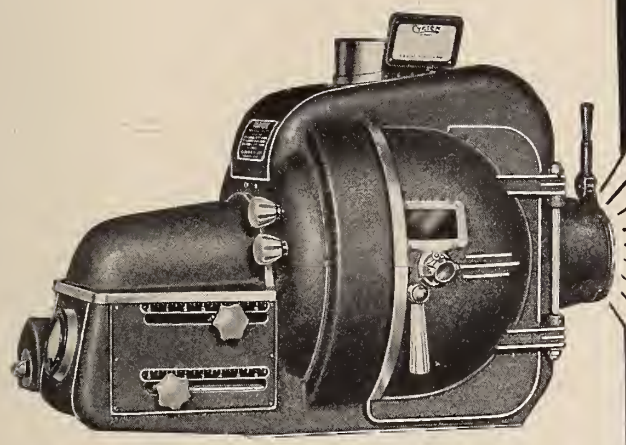
Gain of 5 to 10 per cent in film theatre attendance is indicated as a strong possibility by Standard Trade and Securities in its latest survey of the amusement industries, which points out that "the modest gain in domestic theatre attendance in the recent past is expected to be accelerated in coming months by higher consumer incomes and the seasonal release of better quality pictures."

A CHALLENGE!

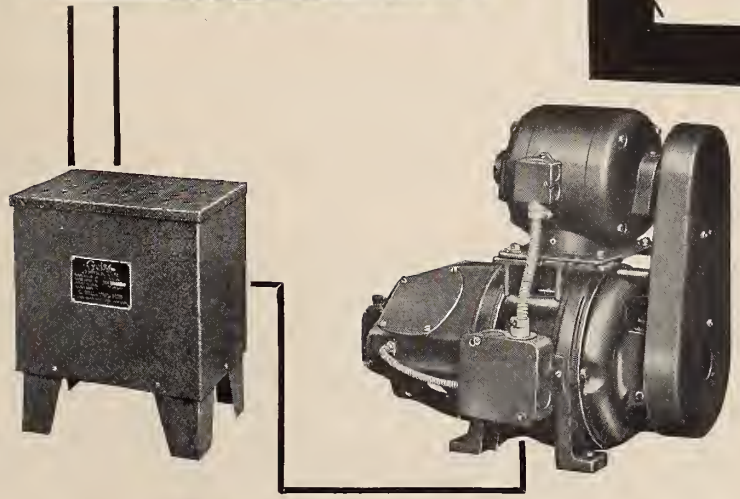
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PATRONS SAY:

"Your pictures are a lot better since you put in those new lamps you were telling me about. Mary and I were saying they are as good as we've seen in any theater. That color feature was as natural as life but what I like most is finding a seat without playing 'blindman's buff.' Believe me, we're steady patrons now."

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The New 'Orotip C' Negative Carbon for Low-Amperage Lamps†

By *W. W. LOZIER, D. B. JOY* and *R. W. SIMON*

ENGINEERING DEPARTMENT, NATIONAL CARBON COMPANY

A new negative carbon makes possible the extension to low current and short arc length of the high-intensity d.-c. arc with copper-coated, non-rotating electrodes. This new negative carbon, known as the "Orotip" C, has made feasible combinations of carbons and burning conditions which effect significant improvements. It has practically eliminated carbide tipping and its undesirable consequences.

Results are given which show that most theatres now using low-intensity carbon arcs have an inadequate level of screen brightness. The new combinations made possible by the "Orotip" C negative carbon offer a remedy for this, while at the same time giving a better color quality and maintaining a total operating cost no higher, or only slightly higher, than for the low-intensity combination.

SINCE the non-rotating h.-i. d-c carbon arc was introduced six or seven years ago it has enjoyed widespread acceptance and has become standard equipment in a majority of the medium-sized theatres. Its simplicity and high efficiency enable it to meet the ever more critical demands for an adequate level of light of suitable color quality. The rapid growth of motion pictures in natural color has greatly accentuated these demands.

However, while the large and medium-sized theatres throughout the country have adopted the high-intensity arc, over sixty per cent of the theatres in this country are still using the l.-i. arc. In addition to a less desirable quality of light for colored motion pictures, many of these theatres are operating with a light-intensity falling far below the minimum brightness recommended for comfortable viewing.

In order to form a mental picture of the screen brightness now being obtained in theatres using low-intensity lamps it is necessary to know the amount of light falling on the screen, the reflectivity of the screen employed, and its size. Reflection characteristics of the screen vary considerably, depending on the type and condition of the screen; however, in the discussion to follow, 75 per cent reflectivity for diffusing screens in good condition has been used.

The SMPE recommendation for screen brightness calls for 7 to 14 foot-lamberts at the center of the screen without film in the projector but with the projector shutter running. For purposes of this discussion, the average of these recommended extremes, 10.5 foot-lamberts, will be used.

Necessary Illumination

Figure 1 shows the total lumens necessary to illuminate screens of various widths to a central brightness of this magnitude. The decrease in brightness from the center to the sides of the screen has been taken as 30 per cent in calculating these values. Had a more uniformly lighted screen been assumed, the lumen values would have been higher.

Tests made in the laboratory and in theatres have indicated that l.-i. lamps and optical systems in good condition can project approximately 2400 lumens of light to the screen without the projector shutter running and without film in the machine. A 90° projector shutter reduces this to 1200 lumens, and reference to Fig. 1 indicates that this amount of light will give a center brightness of 10.5 foot-lamberts or more only with screens 12 feet wide or less.

Previous data on screen sizes in use have not segregated the theatres using l.-i. lamps from those using h.-i. lamps. Therefore during 1939 the National Carbon Co. made a survey of the screen sizes in 122 theatres using l.-i. lamps. These theatres were scattered all over the U. S., so that it is reasonable to believe that the data are representative.

The results of this survey are given in Fig. 2, which shows both the frequency distribution and the cumulative total of the different screen sizes. The screens range from 11 to 23½ feet in width, 85% being 18 feet wide or

†J. Soc. Mot. Pict. Eng. (Oct. 1940).

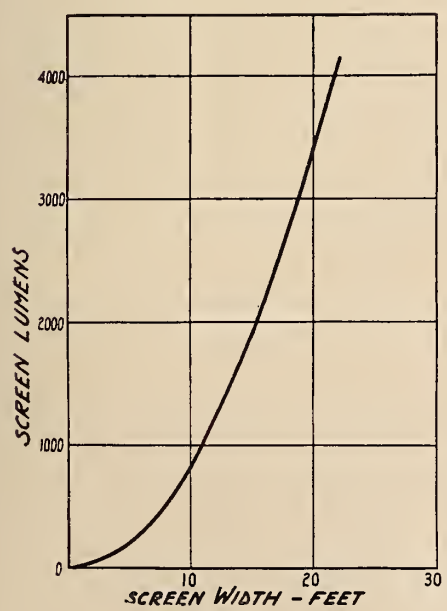


FIGURE 1

Screen lumens vs. screen width to give 10.5 foot-lamberts center brightness with 75 per cent screen reflectivity and 70 per cent side-to-center screen distribution

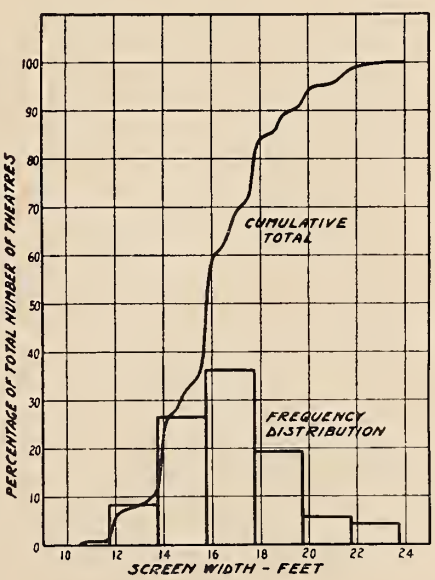


FIGURE 2

Survey of screen widths in 122 theatres using low-intensity carbon arcs

less, while only 5% have a width of 12 feet or less. Therefore this survey indicates that only 5% of the theatres now using l.-i. lamps have sufficient light to illuminate their screens to a central brightness of 10.5 foot-lamberts. As indicative of the remainder, it should be noted that a screen 18 feet wide would have a central brightness of only about 4.5 foot-lamberts with low-intensity arc illumination.

It should be realized that these figures throughout are based on favorable conditions of light output and screen reflectivity. Where these conditions are not maintained the light levels are even lower than those indicated.

That there is a decided need for a higher level of screen illumination in theatres now using l.-i. arc illumination does not require further demonstration. The most important qualifications demanded of a light-source capable of accomplishing the desired result are

(1) A higher light output than the l.-i. arc

(2) A satisfactory light quality for the projection of colored motion pictures

(3) A low cost of operation

(4) A satisfactory burning performance.

Present "Suprex" Carbons

The sizes of Suprex carbons most widely used today are the 8-mm positive with the 6.5-mm or 7-mm negative, and the 7-mm positive with a 6-mm negative carbon. A 6mm—5-mm Suprex trim was introduced along with the larger sizes but did not attain appreciable usage because the small size of this light-source did not give proper coverage at the aperture with the optical systems employed, which were designed primarily for the larger carbons. Also, this trim gave difficulty from carbide tip formation except when burned at the higher currents and consumption rates.

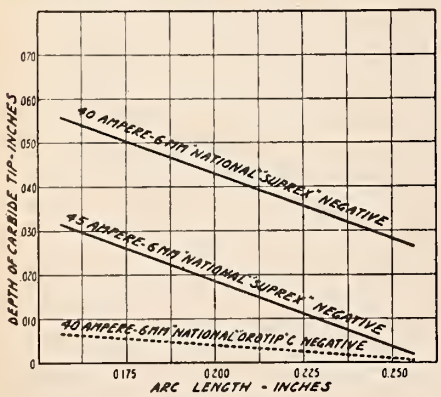
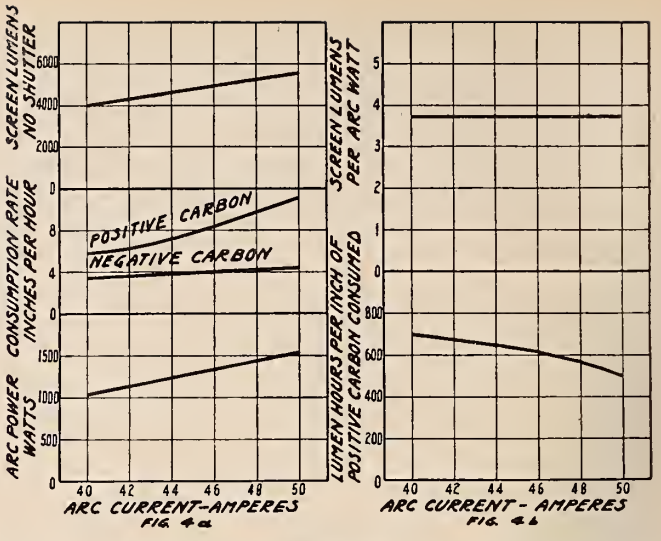


FIGURE 3

Carbide tip vs. arc length at different currents for 6-mm "National" "Suprex" and "National" "Orotip" C negative carbons with 7-mm "National" "Suprex" positive carbons

FIGURE 4

Burning characteristics of 7-mm "National" "Suprex" positive—6-mm. "National" Orotip C negative vs. current at constant arc length of 0.175 inch



The 7-mm—6-mm trim, although rated for operation over a current range of from 50 to 42 amperes, when burned below 45 amperes, had much the same limitations as the 6mm—5-mm trim. Consequently, practically all the usage of Suprex carbons has been at currents no lower than this value.

At this minimum practical limit of 45 amperes, the 7-mm—6-mm Suprex trim gives with an $f/2.5$ optical system approximately 5000 lumens on the projection screen without the shutter running, or 2500 lumens with a 90-degree shutter. This value is approximately twice the maximum attainable under favorable conditions with the l.-i. arc.

Effects of Carbide Tip

As mentioned previously, when the current with the 7-mm—6-mm trim is reduced below 45 amperes, or correspondingly, when the 6-mm—5-mm trim is used in the lower part of its operating range, a coating of rare earth carbide forms on the negative tip.

This carbide tip disintegrates forcibly if present during the striking of the arc and causes a shower of sparks. Also, when allowed to cool this carbide tip is a poor conductor of electricity and in some cases becomes insulating enough to prevent restriking of the arc. In addition, during burning, the carbide tip covers the core of the negative carbon, thereby reducing its intended effect of steadying the arc. This frequently results in wandering of the arc and unsteady light on the screen.

Usually the carbide tip on the negative carbon builds up over a period of 5 to 10 minutes, thereby changing the characteristics of the arc during this formation period. This may have the effect of requiring more attention to lamp adjustment during the burning of the trim, particularly as regards the position of the negative and the adjustment of feeding mechanism. It thus became apparent that it would be an achievement of considerable importance if the formation of the carbide tip on the negative carbon could be prevented.

In the course of the ensuing experimental work the effect on carbide tip of the various characteristics of the negative and the burning conditions of the arc were studied. It was found, for instance, that carbide tip could be reduced by operating with comparatively long arc lengths and also with high currents, as is the case with the present method of operating Suprex carbons.

However, both high currents and long arc lengths make for high power usage and rapid carbon consumption, so that they do not fit in with the goal of supplying an economical combination for the small-sized theatre.

Experiments also showed that a reduction of the diameter of the negative carbon would substantially reduce carbide tip. This step, however, would increase the consumption rate of the negative carbon and so is likewise not in harmony with the object of obtaining a carbon trim economical to operate. The solution to the problem came as the result of the development of an entirely new negative carbon, known as the Orotip C carbon.

'Orotip' C Test Results

When carbide tip occurs to any considerable extent it forms a hemispherical cap over the end of the negative carbon, and in experimental tests the extent of the carbide tip has quantitatively been gauged by noting the apparent depth of this cap. That the Orotip C negative carbon has effected a remarkable reduction in carbide tip is shown by Fig. 3.

Here, the depth of carbide tip on the negative carbon is given for both the Orotip C and the regular Suprex

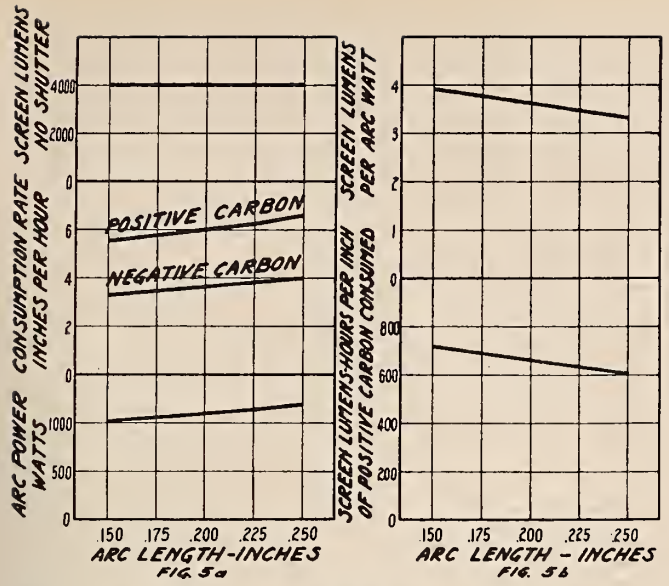


FIGURE 5

Burning characteristics of 7-mm. "National" "Suprex" positive—6-mm. Orotip C negative vs. arc length at constant current of 40 amperes

negative for different arc lengths and arc currents. The amount of carbide tip with the Orotip C negative under the conditions of Fig. 3 is less than 0.01 inch, which is too small to be conveniently measured with accuracy. It has therefore been estimated by the dashed line in Fig. 3.

These results show that to obtain with the Suprex negative the same degree of freedom from carbide tip as with the Orotip C negative carbon, the current must be kept above 45 amperes or the arc length must be maintained longer than 0.25 inch, as is usual practice with present simplified h.-i. trims.

The freedom from carbide tip shown by the Orotip C carbon has made feasible combinations of carbons and burning conditions hitherto considered impracticable. As shown in Fig. 3 it is possible to operate the Orotip C at currents as low as 40 amperes and arc lengths as short as 0.15 of an inch, without encountering an undesirable amount of carbon tip. The employment of these low currents and short arc lengths brings with it worthwhile improvements in efficiency which will now be described.

Improved Arc Efficiency

Using the 7-mm Suprex positive with a 6-mm Orotip C negative carbon, laboratory tests have been made on the various arc characteristics at different currents and arc lengths. Fig. 4 shows the results obtained with this trim at a constant arc length of 0.175 inch in a lamp having a 7.5:1 magnification mirror, which had approximately the same speed as the *f*/2.5 projection lens employed.

As shown in Fig. 4(*a*), when the current is reduced from 50 to 40 amperes, the screen light, carbon consumption rate, and the arc power all decrease.

There are two quantities which relate to the efficiency of the arc. One of these describes the lumens projected to the screen in terms of the electrical power consumed, and the other describes the lumen-hours projected to the screen in relation to the amount of positive carbon consumed.

As shown in Fig. 4(*b*) the amount of screen lumens per arc watt remains essentially constant when the current is reduced from 50 to 40 amperes, so there is no change in efficiency of utilization of electrical power. However, this same figure shows a gain of 40 per cent in the total amount of light-energy obtained from a unit length of positive carbon. This light-energy, measured in lumen hours per inch of positive carbon consumed, increases from 500 at 50 amperes to 700 at 40 amperes.

This gain in efficiency of carbon utilization at the lower current is made practicable by the use of the Orotip C negative carbon which permits low-current operation without appreciable carbide formation.

Figure 5 shows the results of tests made with the same lamp and optical set-up as described for Fig. 4, but in these latter tests the arc current was maintained at 40 amperes and the arc length was varied from 0.15 to 0.25 inch. This reveals further important gains in efficiency through operation at short arc lengths.

One very important fact illustrated in Fig. 5 (*a*) is that the screen light is not altered by operating at arc lengths as short as 0.15 inch. This feature has been recognized for some time but was not practicable to use because of the formation of carbide tip at short arc lengths.

Figure 5(*a*) shows also that reduction of the arc length from 0.25 to 0.15 inch results in a decrease of 15% in both carbon consumption and arc watts. As shown in Fig. 5(*b*), this results in a 15% improvement in efficiency of utilization of both power and carbon for producing screen light.

To summarize, therefore, it has been shown that the low current and short arc length operation made possible by the Orotip C negative has resulted in a marked improvement in the efficiency of production of light from the standpoints of both carbon utilization and power consumption.

The foregoing discussion has pertained chiefly to the 7-mm—6-mm trim of carbons. Similarly, the Orotip C negative makes possible the use of a combination of smaller carbons at low currents and short arc lengths without the appreciable formation of carbide tip.

Power Source Effect

The effects of the characteristics of the power source on the stability of the non-rotating high-intensity d.-c. arc have been fully discussed in a previous article.[1] In that discussion it was shown that a low-voltage power source with only a slightly falling volt-ampere curve at the arc gave a more stable arc and steadier screen light than a high-voltage power source with a large proportion of ballast. Likewise, in that earlier paper the stabilizing effect of supplementary magnetic flux on the arc was explained.

Both these factors, the characteristics of the power source and the use of supplementary magnetic flux, are necessary to obtain the best stability with the arcs just described.

The feeding mechanism must be capable of feeding the carbons uniformly and maintaining the short arc gap between the electrodes.

With both the 7-mm—6-mm trim and the 6-mm—5-mm trim at low currents and short arc lengths, the light-source is smaller than is the case with the sizes of carbons and currents ordinarily used in Suprex lamps. The magnification of the mirror collecting the light must be sufficient to cover the motion picture aperture. New lamps on the market have taken account of this and are equipped with mirrors having the higher magnification ratio.

Theatre Application

Table I shows data on the 6-mm—5-mm and the 7-mm—6-mm trims using the Orotip C negative and also shows comparable data on the 12-mm—8-mm l.-i. trim. The screen lumens per arc watt for these h.-i. trims are from 2½ to 3 times as great as for the l.-i. arc.

[1] Joy, D. B., and Geib, E. R.: "The Non-Rotating High-Intensity D-C Arc for Projection," J. Soc. Mot. Pict. Eng., XXIV (Jan., 1935), p. 49.

Carbon Combination	Amperes	Arc Volts	Arc Watts	Screen Lumens No Shutter*	Screen Lumens per Arc Watt	Width of Diffusing Screen of 75% Reflectivity** Minimum Recommended Brightness, 7 Ft-Lamberts	Mean of Recommended Range of Brightness, 10.5 Ft-Lamberts	Maximum Recommended Brightness, 14 Ft-Lamberts
12-mm—8-mm "National" "SRA" low intensity	32	55	1760	2400	1.4	14.7 feet	12.0 feet	10.4 feet
6-mm "National" "Suprex" positive—5-mm "National" "Orotip" C negative	30	27.5	825	3300	3.6–4.0	17.2	14.0	12.1
7-mm "National" "Suprex" positive—6-mm "National" "Orotip" C negative	40	27.5	1100	4000–4300	3.6–4.0	19.3	15.7	13.6

* Values measured with an $f/2.5$ lens.

** Assuming 90° projector shutter and 70% side to center screen light distribution.

—TABLE I—

This is an important feature, and contributes to the achievement of a total operating cost with these h.-i. trims no higher or only slightly higher than for the l.-i. combination despite the fact that they give a much greater amount and better color of light.

The last three columns of Table I show the size of a diffusing screen of 75% reflectivity which can be illuminated by these light-sources to center brightness values of minimum (7 foot-lamberts), mean (10.5 foot-lamberts), and maximum (14 foot-lamberts) recommended screen brightness.

The results of the survey on screen sizes shown in Fig. 2 indicate that l.-i. carbons and lamps deliver enough light to furnish desirable screen brightness for only a small percentage of the theatres now using this combination. These new low-amperage h.-i. 6-mm—5-mm and 7-mm—6-mm carbon combinations (together with the regular Suprex combinations for the largest screens) extend to the theatres now using l.-i. arcs a practicable means of increasing their screen brightness to the recommended range and, in addition, give them the same desirable color quality of light as the theatres now using the h.-i. combinations.

Discussion:

MR. EDWARDS: If we maintain a closer arc with the new Orotip C, with consequently less cost per lumen, then why not increase the size to 8-mm, 60 amperes?

MR. WILLIFORD: All the improvements can not come out at once. We are aware of the industry's desire for greater screen illumination, and have been working toward that goal for many years. Intensities have steadily been going up. The question of screen light standards has been raised, and the Society has been loath to recommend the standards that we think we ought to have until we have optical systems, light-sources, and screens that will give us those standards. There is no reason why everyone can not today have 10 foot-candles on his screen.

MR. EDWARDS: Provided the screen width does not exceed 18 feet.

MR. WILLIFORD: He can have it, even so. With developments now under way he can go to higher intensities on any screen. It has been a matter of development in various channels, including the matter of lens surfaces. With improvements in optical systems, screens, and light-sources we are making it possible to get the levels of screen illumination the industry believes it should have. I can not promise how soon some of these later developments will enter the larger theatres, but they are definitely in the offing, and the results today are exceedingly promising.

MR. GRIFFIN: The Standards Committee has already revised the previously recommended screen brightness, I believe.

MR. JOY: The recommended practice at the present time is 7 to 14 foot-lamberts at the center of the screen. That means, in terms of foot-candles, with a 75 per cent reflection factor, about 9 to 18 foot-candles. For an average of, say, 10 foot-candles, we should have about 12 or 13 at the center and falling off toward the edges.

MR. MCAULEY: If we take into account the increased projector shutter speeds; the use of 70-degree shutters instead of 90-degree; the widespread use of high-intensity arcs instead of low-intensity or any of the neutral-cored carbons; the increased efficiency of the optical systems—that is keeping pace pretty well with the demand that colored pictures have created for increased illumination.

All Warner—Erpi Contracts Out, Closing a Movie Era

All existing contracts between Warner Bros. Pictures and Electrical Research Products have been discontinued as of Dec. 4 by mutual agreement, it is announced by the former. Agreement covers not only Warner Bros. and its subsidiaries, both foreign and domestic, but Erpi subsidiaries as well.

Deal formalizes an accomplished fact of several years' duration, since Warners have been recording exclusively on RCA equipment for this length of time, which move was not given the press attention it warranted and thus was known to but few in the industry.

So ends an era in the history of motion pictures in that Warners, through Vitaphone and in close collaboration with Erpi, were the pioneer sponsors of sound motion pictures in theatres and really provided the means for Erpi's entry into and subsequent large-scale operations in the industry. It is interesting to contrast the comparative brevity of this item with the innumerable columns of type and impressive headlines that heralded the first Warner-Erpi steps and subsequent progress in the sound picture art.

URGE STRONGER FILM VAULTS

Fire tests of motion picture films, concluded at the National Bureau of Standards are expected to result in a recommendation that the structural strength of storage vaults for such films should be increased above present day standards.

Reserving a final report until data gathered at the experiments could be more fully examined, the Bureau observed: "We have now conducted sufficient experiments to suggest that if the present standard of vent area equivalent to 7 pounds of film content per square inch is to be employed, more structural strength in storage vaults for films is to be recommended."

ACADEMY'S ARMY REELS

Research Council of M. P. Academy expects to produce at least 100 reels of training pictures for the Army draftees during the coming year. The Council has been assured of initial Government appropriations of $250,000 to launch the program.

Scripts for the pictures, which will be exhibited solely to draftees and other soldiers for training purposes, will be furnished by members of the Army's Signal Corps. Subjects are to range in length from one to five reels.

• • •

Our warning of several months ago anent a probable shortage of replacement parts, no less than of new complete units, resulting from national defense requirements, now shapes up as having been an understatement. There still is time, however, to escape the more serious consequences of this situation by calculating future requirements and placing orders for same immediately. This situation appears certain to become more acute with every passing day. A word to the wise. . . .

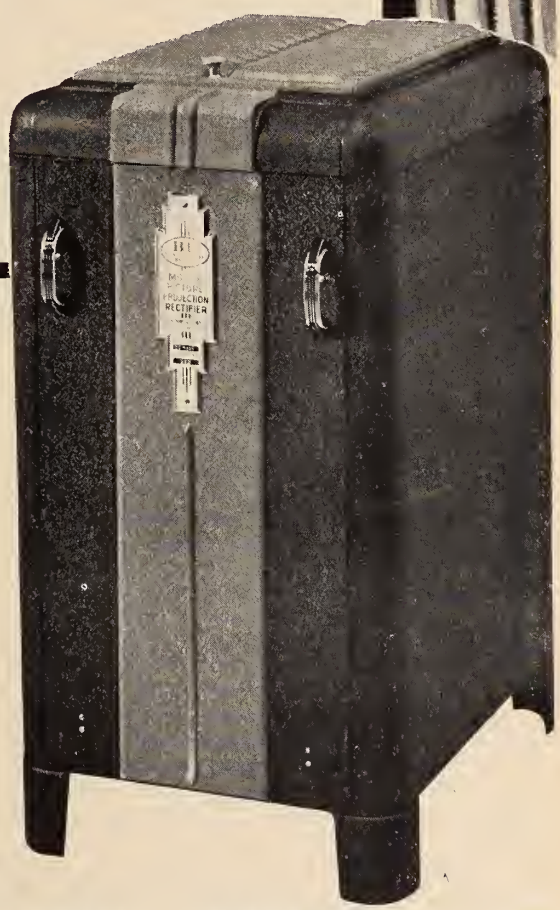
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RCA's 'FANTASOUND' SYSTEM as Used for DISNEY'S 'FANTASIA'

By *R. J. KOWALSKI*
SERVICE DIVISION, RCA MFG. CO., INC.

If you can imagine a sound system that utilizes 36 speaker units on the stage alone, plus 22 small cabinet-type speakers scattered throughout the auditorium; if you can imagine the magnificent reproduction accorded by this combination of speaker units to a superb recording of some of the world's greatest music by one of the finest symphonic orchestras ever assembled; if you can imagine a sound track that permits superb delicacy of control over every nuance of sound produced by such an orchestra; if you can imagine a sound system that produces 600 watts of power without overloading; if you can imagine a projection set-up that includes separate heads, interlocked by Selsyn motors, which enable the attainment of absolute synchronism as between the visual and the sound tracks—if you can imagine these salient features of a sound reproducing system, then, and then only, will you appreciate the worth, no less than the significance as a milestone in the technical progress of the motion picture industry, of RCA's new recording and reproducing system—Fantasound.

If, in addition, you can imagine the tieing-in of such a system with an enthralling series of animated drawings in color by an acknowledged master in the art—then you will have some idea of the exquisitely beautiful Walt Disney production—"Fantasia."

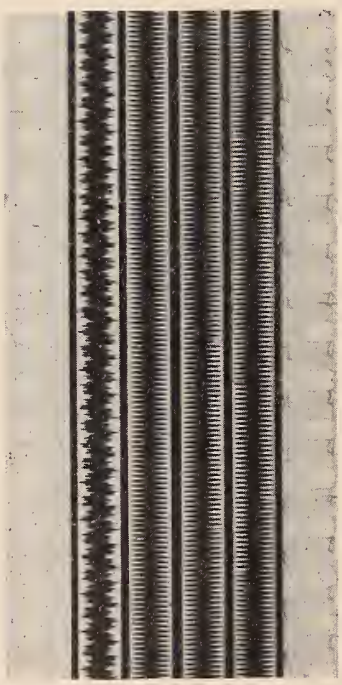
The what, why and how of this new Fantasound recording and reproducing system are detailed in the appended article. In addition, there appear some notes on projection equipment and procedure incident to the showing of "Fantasia," as well as advanced word on a somewhat modified version of Fantasound equipment which, under the name of Vitasound, will be installed first in all Warner theatres and will subsequently be made available to all theatres.—J. J. F.

DISNEY'S latest feature length production, "Fantasia," now having its premier showings in New York City, has aroused extraordinary interest in film circles. Unlike anything produced to date, "Fantasia" can best be described as an illustrated concert which combines the music of the masters ranging from Bach to Stravinsky with the unparalleled cartoon characters and artistry of Walt Disney. It consists of eight well-known classical compositions recorded by the Philadelphia Orchestra under the direction of Leopold Stokowski. Each selection is accompanied by a suitable cartoon story which gives a visual interpretation of the music. Deems Taylor, well-known music critic, serves as narrator to describe the purpose and aims of the picture and the interpretation of each selection before it is played.

One commentator, in speaking of the picture, very aptly said that "Fantasia" is revolutionary because it now makes it possible to "see music and hear pictures." However the most unusual feature of this production is not the clever Disney drawings, which are already famous throughout the world; nor is it so much the idea of supplementing music with visual interpretation, which has been used on a smaller scale in Disney's "Silly Symphonies." Rather is it the unique method used in recording and reproducing the sound.

The sound reproduction in this picture reaches unprecedented heights in realism and naturalness. Music and movie critics alike have stated that this picture represents the greatest single advance in the motion picture industry since the advent of sound.

By the use of greater dynamic volume range and advanced application of acoustic perspective principles, it is possible to literally envelope the audience in sound and make the sound appear to move about the auditorium. Before discussing the means by which these effects are accomplished it would be well to briefly describe the equipment used.



'Fantasound' sound film, approx. 1¼ times actual size. Left, the automatic control track for the three standard sound tracks at right. Detailed description in accompanying article

3 Sound Systems in 1

The RCA Fantasound system is really three complete sound systems of a special type combined into one. A simplified block diagram of the system is shown in Fig 1. In presenting the picture two films are run simultaneously, one a standard film with picture and soundtrack, and the other a special 35 mm. sound film with four double-width soundtracks. Three of the soundtracks are standard program tracks carrying music and dialogue, while the fourth is a special control track that will be described in detail subsequently.

The sound film is run through a special multi-track soundhead, shown in Fig. 2, which is synchronized with the associated picture projector by means of a Selsyn drive. Provisions have been made to run the two special soundheads in conjunction with any two of the three available picture projectors.

The signal outputs of the four soundtracks pass through a special relay fader system and are amplified by four separate pre-amplifiers. Each of the three amplifiers handling program material feeds a special variable gain amplifier, which in turn feeds a 30-watt driver amplifier. Each driver amplifier feeds

two 60-watt power amplifiers connected in parallel, giving a rated output of 120 watts per channel. While these amplifiers are rated at 120 watts, it was found in tests that they actually delivered 200 watts with less than 2% distortion. This makes a total of 600 watts of undistorted power output available for the three main channels.

To handle this tremendous power output three huge de luxe loudspeaker systems are located on the left center, and right side of the stage. Each setup has 4 large folded type low-frequency baffles with 8 low-frequency speaker units, and one large cellular high-frequency horn with special throat and 4 high-frequency speaker units. This gives a total of 36 de luxe speaker units on the stage!

Two additional 50-watt power amplifiers are connected to the driver amplifiers on the two side channels through suitable attenuator pads. Each of these amplifiers drives 22 small cabinet-type loudspeakers that are distributed about the auditorium.

The Automatic Control Track

The fourth, or control, track recording on the sound film automatically controls the gain of the three variable gain amplifiers in the three main amplifier channels and hence automatically controls the loudness of the reproduction from each of the speaker set-ups. The control track is a recording of three different artificial oscillator tones of varying intensities superimposed on one another. The three tones are amplified by the control track pre-amplifier, then further by the amplifiers in the control track, and finally passed into filters which separate the tones from one another and feed each to the proper variable-gain amplifier.

The gain, or "volume-control setting," of the variable-gain amplifier is determined by the strength of the control tone that reaches it. Hence, by increasing the intensity of one control tone with respect to the others on the soundtrack it is possible to make the gain of one amplifier channel greater than the others and the reproduction from one set of speakers louder than the others.

With this brief description of the function of the Fantasound system let us see how it is possible to get more realistic reproduction than can be obtained with a standard system.

A recording of a symphony orchestra reproduced by a standard system does not have all of the tone color and spirit of the original because the volume or dynamic range has to be *compressed* when the recording is made. Physical limitations of the recording system make compression necessary. The smallest modulation that it is practical to record on a soundtrack is limited by the film background noise. The limit is reached when the ratio of signal to noise becomes so small that noise becomes perceptible in reproduction.

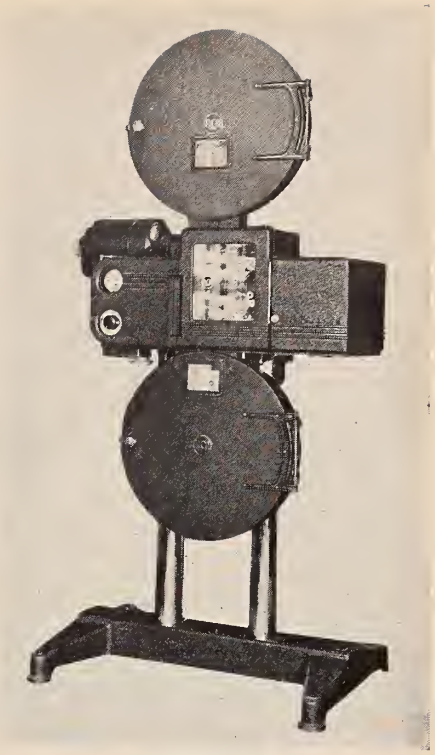


FIGURE 2
Multi-track soundhead, synchronized with picture film head by means of Selsyn drive

The largest modulation that can be recorded is 100% when the peaks of the recorded wave extend to the very edges of the soundtrack area. The dynamic or volume range between these two limits is approximately 35 decibels; whereas the actual range of a symphony orchestra is approximately 70 decibels. Thus a means must be provided for restoring the 35 decibels that were lost because it was necessary to compress the range in the recording process.

If it were possible for the projectionist to twirl the volume control knob rapidly enough according to a complete set of cues, he could continually boost or reduce the gain by just the right amount at the right time and thus compensate for the compression introduced during recording. However, because of the innumerable changes required, this is too tough an assignment, hence some sort of automatic means must be used. In the Fantasound system this means is the control track and the variable-gain amplifiers which are inserted in each amplifier channel.

The control track was recorded after the final re-recordings of the program tracks were made in approximately the following manner. The output of an oscillator generating a single artificial tone, let us say 250 cycles, was con-

(*Continued on 3rd page following*)

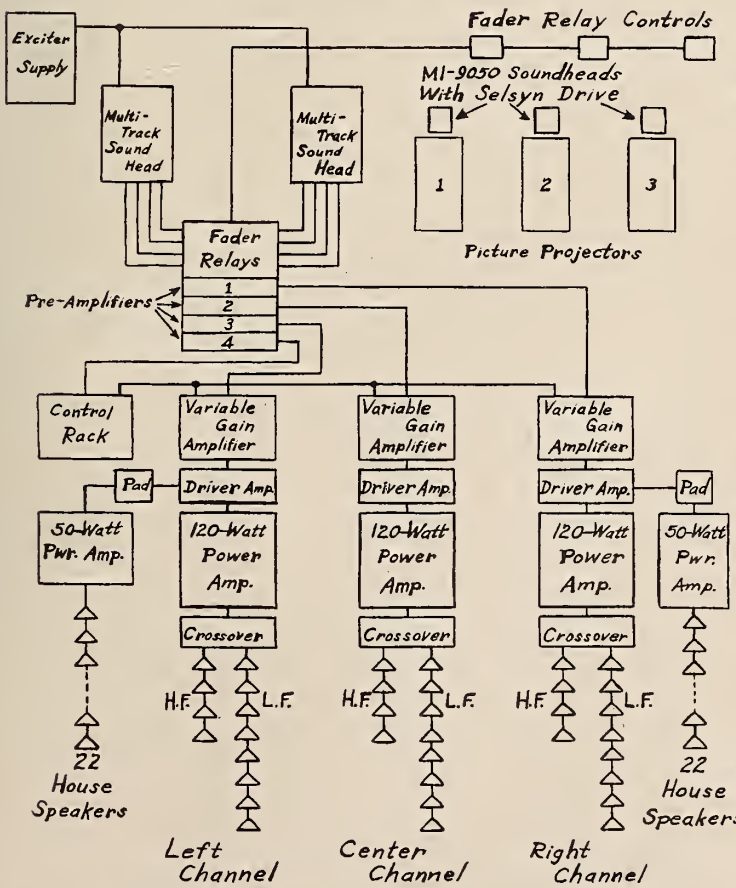


FIGURE 1
Simplified block diagram of the 'Fantasound' system set-up, which is really three complete sound systems in one, and which produces 600 watts of power

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Several modern amplifiers are available, it is true, but at a price and size that prevent many exhibitors from purchasing them. ELSCO equipment, because of its extremely high efficiency, compact size, low cost, and adaptability to *any* existing type of speaker equipment or any soundhead, meets the demands of exhibitors operating theatres of up to 2000 seats.

The day of bulky, rack-type sound reproducers, which include many unnecessary components to get out of kilter, has long since passed. ELSCO Amplifiers are the product of a technical laboratory having 20 years experience in the manufacture of radio and high-grade test equipment. Their design has emerged from extensive tests with flying colors.

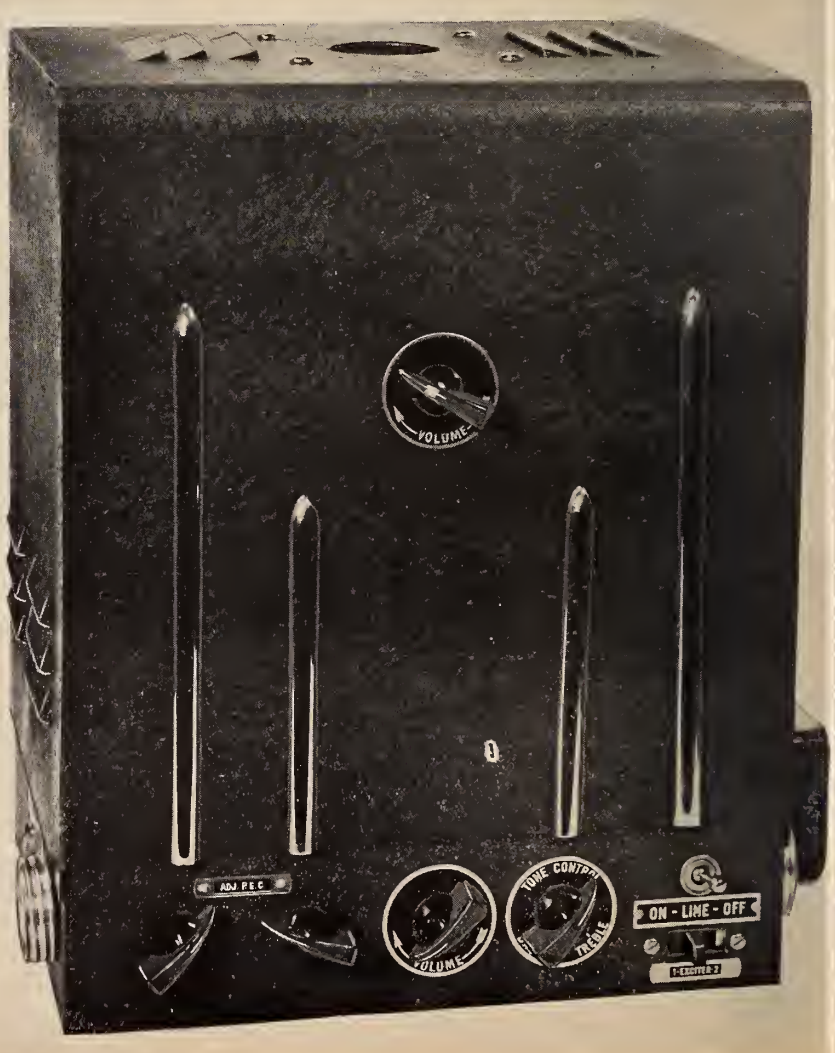
Heretofore the price of theatre sound equipment has reflected not quality but merely what load the market would bear —which explains the use in some current sound equipment of wholly unnecessary adjuncts intended to impress the purchaser.

ELSCO sound units are the modern, streamlined answer to the problem of obtaining superb sound reproduction on a basis of trouble-free operation, long life, and low cost.

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satisfaction.

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ur.

or 9 volts at 4 amperes.

★ Is equipped with gain and tone compensation.

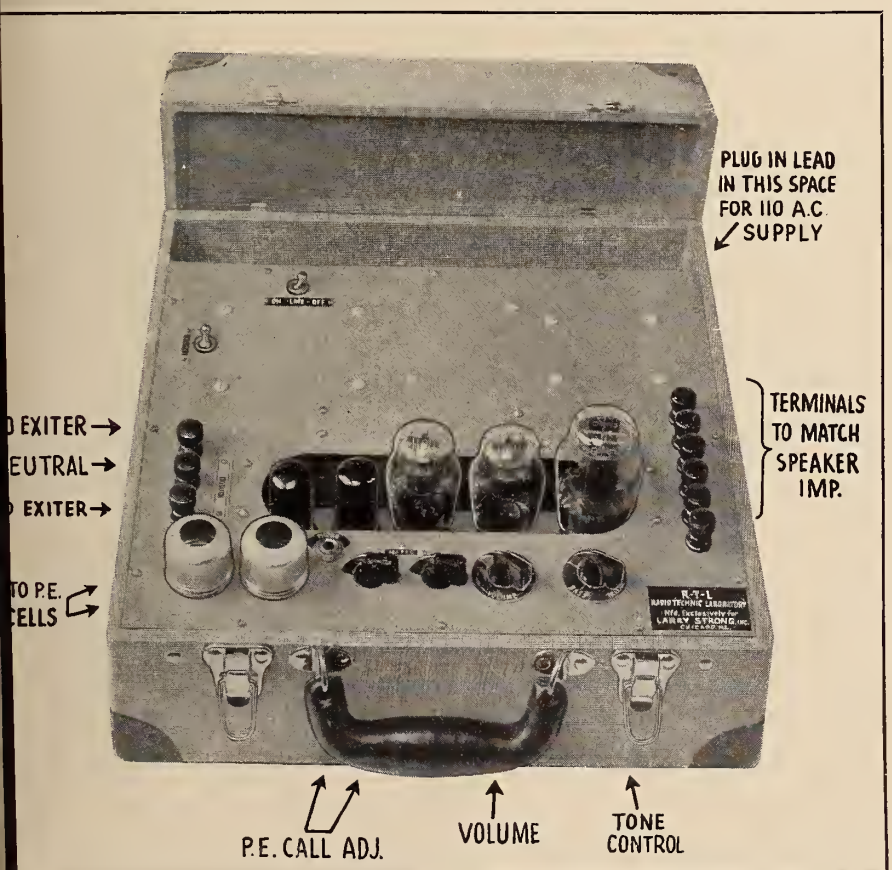
★ Filter condensers are of the plug-in type, similar to tubes, and may be replaced without the use of a soldering iron.

★ Enables independent theatre supply dealers to regain their independence by making available to their customers a sound unit not exceeded in quality by any other equipment and with a warranted long life of trouble-free operation with minimum service costs.

STS IN 25 WHOLLY DISSIMILAR THEATRES

hicago circuit performed so faultlessly and induced so uch enthusiasm on the part of the owner as to result eight additional sales to his fellow-exhibitors within week.

ELSCO Amplifiers will render the same highly effient, trouble-free service in your theatre—*any* theatre. rial of an ELSCO Amplifier implies no obligation, nce all ELSCO units are warranted by the manucturer to give complete satisfaction. ELSCO Amplifers will match *any* existing speaker equipment and ill couple to *any* soundhead.



PRICE

$135.

COMPLETE

ELSCO Amplifiers have been demonstrated under actual theatre operating conditions to 21 independent theatre supply dealers. This group of experienced equipment men is unanimous in hailing the ELSCO Sound Units as one of the most progressive steps ever taken in the supply field.

The introduction of ELSCO Amplifiers means far more to the independent supply dealer than the mere availability of high-efficiency low-cost equipment warranted as to trouble-free operation and long life. It means, in addition, that all independent dealers now are provided with a source of supply for sound units the merchandising of which is a straightaway, clear-cut business transaction of so much money for so much equipment. No extraneous matters—especially as relates to what amounts to the forced sale of other equipment—clouds ELSCO merchandising policy.

The availability of ELSCO Amplifiers will enable the independent dealer to regain that degree of independence which is denied him under some existing distributing agreements—and it also will enable him to *make that profit to which he is entitled as a legitimate dealer!*

Independent theatre supply dealers everywhere are invited to investigate the technical excellence of ELSCO Amplifiers, and, in addition, to acquaint themselves with ELSCO's merchandising policy which enables them to at once serve their customers in a highly satisfactory manner and to protect their own interests. Write us today for full details anent ELSCO equipment.

LARRY STRONG, INC.

1241 So. Wabash Ave.
Chicago Illinois

Sensational New **ELSCO** *Theatre Amplifier Matches the Best Existing Units in Every Detail—Except Size and Price!*

★ Covers entire recording range of from 30 to 9000 cycles. Ample power for theatres having up to 2000 seats. Operates on 110-220 volt, 50-60 cycle A. C.

★ Will match *any* existing speaker equipment and can be coupled to *any* soundhead, regardless of type.

★ Extremely compact: weighs only 20 lbs., and is only 9½" wide, 8½" high and 8" deep. Eliminates many useless components of large rack jobs, with consequent saving in cost, upkeep and elimination of service fees. Long life and trouble-free operation warranted.

★ Latest inversion-type circuit. Minimum number of tubes used, which can be obtained at any radio store. Supplies its own p. e. cell voltages, which are adjustable. Is coupled direct to p. e. cells by means of low-capacity cables fully shielded.

★ Installation time does not exceed one hour.

★ Supplies its own exciter voltages for 8, or 9 volts at 4 amperes.

★ Is equipped with gain and tone compensation.

★ Filter condensers are of the plug-in type, similar to tubes, and may be replaced without the use of a soldering iron.

★ Enables independent theatre supply dealers to regain their independence by making available to their customers a sound unit not exceeded in quality by any other equipment and with a warranted long life of trouble-free operation with minimum service costs.

TIME-TESTED AND PROVEN BY EXACTING TESTS IN 25 WHOLLY DISSIMILAR THEATRES

ELSCO Amplifiers were not offered to the trade until they had been subjected to an extensive and exhaustive series of tests in 25 theatres having, in the aggregate, wholly dissimilar operating and acousiteal characteristics. Whether the consideration was frequency range, tone fidelity, ease of installation and operation, compactness, reliability and complete absence of even the slightest trouble—whatever yardstick was used, ELSCO units demonstrated their worth and delivered 100% satisfaction.

In fact, ELSCO installations in three theatres of a Chicago circuit performed so faultlessly and induced so much enthusiasm on the part of the owner as to result in eight additional sales to his fellow-exhibitors within a week.

ELSCO Amplifiers will render the same highly efficient, trouble-free service in your theatre—*any* theatre. Trial of an ELSCO Amplifier implies an obligation, since all ELSCO units are warranted by the manufacturer to give complete satisfaction. ELSCO Amplifiers will match *any* existing speaker equipment and will couple to *any* soundhead.

ELSCO — The Modern Streamlined Theatre Amplifier Unit

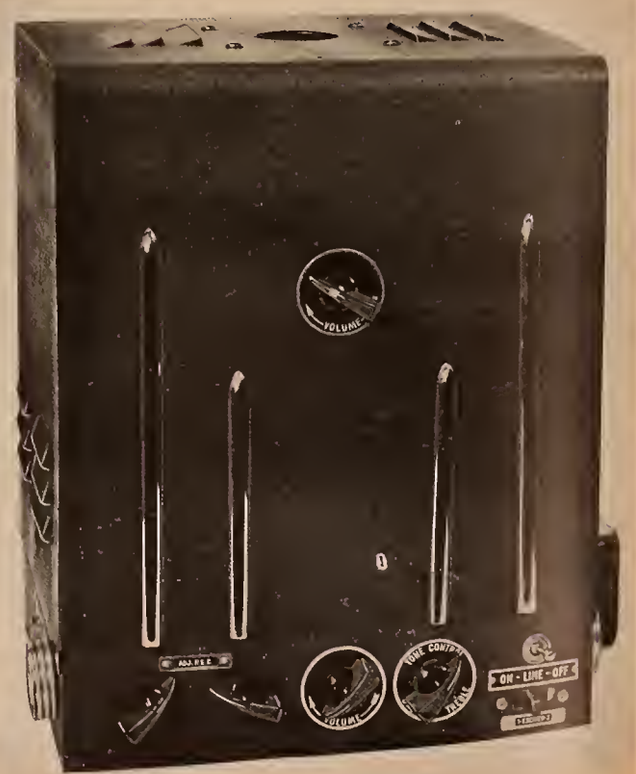
ELSCO Amplifiers solve the problem of innumerable exhibitors now operating with obsolete equipment, bulky in size and difficult to service, which is utterly incapable of reproducing the extended frequency range recordings now turned out by practically all studios. The annual cost of maintenance alone on this obsolete equipment, apart from trouble it gives, would go far to pay for a modern 1941 ELSCO sound unit.

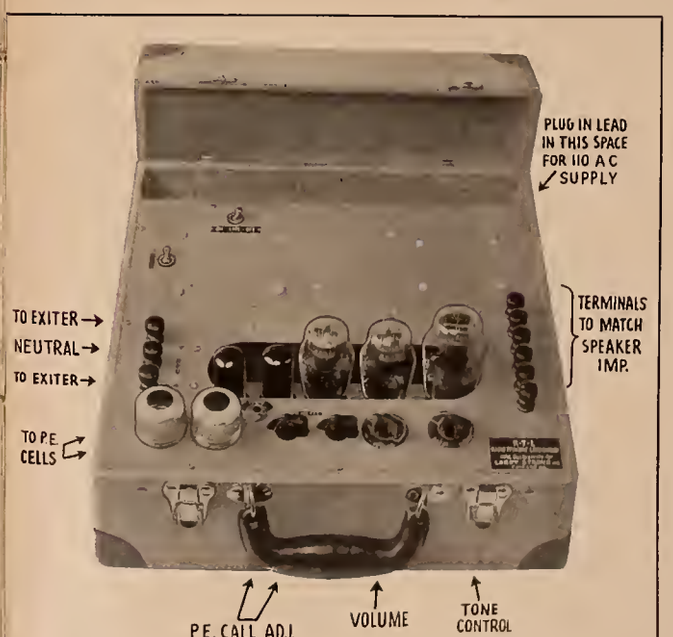
Several modern amplifiers are available, it is true, but at a price and size that prevent many exhibitors from purchasing them. ELSCO equipment, because of its extremely high efficiency, compact size, low cost, and adaptability to *any* existing type of speaker equipment or any soundhead, meets the demands of exhibitors operating theatres of up to 2000 seats.

The day of bulky, rack-type sound reproducers, which include many unnecessary components to get out of kilter, has long since passed. ELSCO Amplifiers are the product of a technical laboratory having 20 years experience in the manufacture of radio and high-grade test equipment. Their design has emerged from extensive tests with flying colors.

Heretofore the price of theatre sound equipment has reflected not quality but merely what load the market would bear—which explains the use in some current sound equipment of wholly unnecessary adjuncts intended to impress the purchaser.

ELSCO sound units are the modern, streamlined answer to the problem of obtaining superb sound reproduction on a basis of trouble-free operation, long life, and low cost.





PRICE $135. COMPLETE

ELSCO Amplifiers have been demonstrated under actual theatre operating conditions to 21 independent theatre supply dealers. This group of experienced equipment men is unanimous in hailing the ELSCO Sound Units as one of the most progressive steps ever taken in the supply field.

The introduction of ELSCO Amplifiers means far more to the independent supply dealer than the mere availability of high-efficiency low-cost equipment warranted as to trouble-free operation and long life. It means, in addition, that all independent dealers now are provided with a source of supply for sound units the merchandising of which is a straightaway, clear-cut business transaction of so much money for so much equipment. No extraneous matters—especially as relates to what amounts to the forced sale of other equipment—clouds ELSCO merchandising policy.

The availability of ELSCO Amplifiers will enable the independent dealer to regain that degree of independence which is denied him under some existing distributing agreements—and it also will enable him to *make that profit to which he is entitled as a legitimate dealer!*

Independent theatre supply dealers everywhere are invited to investigate the technical excellence of ELSCO Amplifiers, and, in addition, to acquaint themselves with ELSCO's merchandising policy which enables them to at once serve their customers in a highly satisfactory manner and to protect their own interests. Write us today for full details about ELSCO equipment.

LARRY STRONG, INC.

1241 So. Wabash Ave.
Chicago Illinois

nected both to the input of the control track recorder and to a variable-gain amplifier in a standard reproducing system. As each recording was played through the reproducing system, a musician controlled the output of the oscillator in accordance with a set of cues that had been carefully worked out. As he varied the level of the oscillator signal to the variable gain amplifier, he restored the full dynamic range of the original music to the reproduction. At the same time all of the minute variations in the level of the control tone were being permanently recorded on the control track to be used from then on to automatically control the volume in reproduction.

Tremendous Volume Range

A control track was recorded in the aforementioned way for each of the three program tracks, but a different frequency control tone was used for each. The three resulting control records were then combined into one and recorded on the sound film along with the three program tracks.

The extra volume range obtained by this method is about 40 decibels or about 10,000 times that of a conventional system. This extra amplification would not be of much value if the power amplifiers and loudspeakers were not capable of handling the tremendous peak powers this amplification requires. As described in the foregoing text, a total of 700 watts of audio power with negligible distortion and 80 loudspeaker units were provided to handle these peaks!

Having the loudness of the reproduction as great as that of the original is in itself not enough to give a feeling of realism. In fact, it has been proved that when music is reproduced over a standard single channel, the audience becomes uneasy if the music is made very much louder than normal. This has been found to be due to the fact that theatre loudspeakers are necessarily very directional and, therefore, all the sound appears to come from a single point. This does not mean that directional characteristics of theatre loudspeakers are necessarily undesirable. On the contrary, this characteristic adds greatly to the illusion on dialogue, and helps to obtain acceptable intelligibility under adverse acoustic conditions.

Three Speaker Systems

An orchestra, however, is generally spread out over all of the stage. Many of the sound waves they create are non-directional. It is not surprising, therefore, that the reproduction of such an orchestra over a single channel system with highly directional speakers leaves something lacking.

In the Fantasound system three huge main speaker systems occupy a width greater than that of the sound screen, so that the sound comes from the whole stage and not just one section. In addition to the stage speakers, small cabinet-type speakers are installed along both sides of the auditorium and across the rear. Normally, these are operating at so low a level that the audience does not realize they are there; however, they add materially to the illusion.

When directional stage speakers are used even though they are spread, most of the sound energy is directed down into the audience, and much less sound energy strikes the walls than if a live orchestra were playing. If a person were seated in an auditorium listening to a live orchestra, much of the sound reaching his ear would have been reflected from the walls about him so he gets the illusion of sound coming from all sides. The additional auditorium speakers help simulate this condition in the reproduction of Fantasia and places the audience in the midst of the music.

'Acoustic Perspective'

One further effect which adds realism to the sound reproduction is that of "acoustic perspective", or the process of making sound move about the screen in accordance with the action taking place. This can easily be accomplished with the Fantasound system, since three separate channels are available each with its own signal source and loudspeaker system. Disney uses acoustic perspective to obtain very striking effects in this picture.

The tremendous amount of research and study involved in developing this unique sound system and the experience gained in its installation and test have opened up a complete new field in sound-on-film reproduction. It is felt that many of the advantages of this system can soon be made available to all theatres in a somewhat simplified form.

It is noteworthy that, aside from the special multi-track soundheads and variable gain amplifiers, all components of this special sound system are standard sound reproducing items that are being sold with current theatre sound equipment. This means that if the application of these special recording methods becomes more general, the sound equipments now installed in theatres will not become obsolete but instead may be used as the main part of a new enlarged system.

(To Be Continued)

'Fantasia' Projection Chief 40 Years in the Craft



CECIL WOOD

HEREWITH the likeness of Cecil Wood, I. A. Local 306, director of projection for Walt Disney Corp. in connection with the primer and all other American showings of "Fantasia", the magnificent presentation of which in its New York showing has elicited praise from all quarters. Wood is well-known throughout the industry as a result of his forty years' work as a top-flight projectionist, the chronology of which is as follows:

1900—Broke in with American Mutascope & Biograph Co. as electrician at the Coney Island, N. Y., showings of the Jeffries-Sharkey fight.

1903-10. Appointed N. Y. City Electrical Inspector, in charge of Motion Picture License Bureau.

1911-12. Kinemacolor Co. of America. Shop work, installation and road operating.

1913-14. Manager of N. Y. Motion Picture Center.

1915-19. Epoch Producing Corp., owners of D. W. Griffith's masterpiece, "The Birth of a Nation". Chief projectionist with 12 road companies.

1920-22. Capitol Theatre, N. Y. City, projectionist staff.

1923-25. Peacock Motion Picture Corp., Shanghai, China. In charge of projection, theatre installation and instruction of Chinese projectionists.

1926. Balaban & Katz, Chicago. Installation work in numerous theatres.

1927-37. Installation and instruction work on sound and visual projection for Erpi.

1938. Astor Theatre, N. Y. City, home of Loew's, Inc., roadshow productions.

1939-40. U. S. World's Fair Commission. In charge of projection in Federal Building.

1940. Walt Disney Productions. Director of projection for premier and all subsequent showings of "Fantasia".

Thus the record of Cecil Wood, a record that is a credit to the craft. If there be anybody with a more extensive or more diverse experience, his identity remains a secret.

New Warner-RCA 'Vitasound' System Ready

VITASOUND is the name of the new Warner Brothers sound recording and reproducing system which, following the general pattern of the "Fantasound" system developed for Disney's "Fantasia", has been developed with the cooperation of RCA engineers and is even now being installed in three Warner Coasthouses, the Hollywood and the Downtown in Los Angeles, and the Strand in N. Y. City. The Warner film, "Sante Fe," is the first feature to be recorded *via* the Vitasound system.

Vitasound equipment will be made available subsequently to all theatres that desire to use it, thus following closely the merchandising plan used by Warners for its Vitaphone apparatus when sound pictures were introduced generally 13 years ago.

Vitasound, it is asserted by interested experts, offers completely faithful reproduction of original sounds without requiring extensive and expensive changes in theatre or studio equipment, and gives an audience the benefit of every shade of tone and volume found in the original sound. The system will not upset long established theatre practices nor antiquate all the theatre and studio equipment in the industry. It is said to be neither too complicated nor too expensive for general use.

New Control Track Method

A second sound track on the release print regulates sound control and makes possible startling improvement in results in the theatre. The only added expense involved is a $40 attachment on printing machines and a probable $1,500 investment for additional amplifiers and horns in the theatre. Added horn equipment includes two h.-f. stage units, plus smaller speakers for the procenium and throughout the theatre.

"The new control track method," according to Major Nathan Levinson, of the Warner studio sound department, "is advantageous in that it requires no additional equipment or change in technique in the shooting of pictures. Even the difficult dubbing process is unchanged because the sound control track is printed directly on release prints as they are run through the sound printers.

"This control track does not affect the reproduction of sound in theatres not equipped with Vitasound, and, conversely, ordinary prints will play normally through new equipment in the theatre without actuating the control track mechanism." This interchangeability feature permits the gradual introduction of the new system without occasioning any disruption in the theatre field.

Ask M. P. Academy Approval

In order to make Vitasound available as soon as possible to all producers and exhibitors desiring to take advantage of it, RCA has requested the Research Council of the Academy of M. P. Arts and Sciences to establish standards of manufacture at the earliest possible date. This task should not require much time, because the Vitasound system is not wholly dissimilar to the equipment used for the Erpi stereophonic demonstrations within the past year.

Overall, Vitasound provides a greater volume range with what might be called hairline control, thus making for greater realism and therefore enhanced dramatic effect.

ISAAC WINS DOUBLE HONORS

Two honors were accorded Lester Isaac, director of Projection for Loew's Theatres, Inc., during the past month. First was a dinner tendered him at the Astor Hotel, N. Y., Prudence Lodge, F. & A. M., of which organization Isaac is a former master. Highlight of this affair, attended by more than 800 business, I. A. fraternal, and personal friends of Isaac, was the presentation to the Loew chief of a gold honorary life membership card in Washington, D. C. Local 224, (the first such presentation by this I. A. unit) in recognition of his services as business agent almost 25 years ago.

Subsequently Isaac attended a special meeting of Local 224 to express his thanks for this signal recognition by the Union. He was accompanied on this trip by P. A. McGuire, advertising manager of International Projector Corp., who also has many friends in this I. A. Unit.

NBC Theatre Television Test in N. Y. Early in Jan.

THEATRE television will be given its first real extended test by National Broadcasting Co. shortly after the turn of the year at the 380-seat New Yorker Theatre, 523 Eighth Ave. in N. Y. City. Image will be blown up to fill a 9 x 12-foot screen. Television's immediate future is a bit uncertain at the moment due to the lack of any report by the National Television Systems Committee, now pondering the whys and wherefores of this baby art.

NBC will continue to spend approximately $500,000 annually in television. National defense requirements is one of the major factors in determining the future of television as an industry. The panel reports by the NTSC are now not expected to be completed before the end of January, and at least one report will be delayed until Feb. 15.

Technical Problems Major Concern

At present technical problems are being given preference over programming. The major problems being studied include synchronization, sound, *etc.*, and full cooperation is being given, and will continue to be given, to the NTSC. Of the 34 hours of technical tests held during the past week, 20 hours were held for the NTSC; 6 hours were devoted to programs, and the balance were concerned with FM and sound transmissions.

Color television is also being tested, but is still in the experimental stage, with all the various processes being given full consideration by RCA engineers. However, color tele still is a vague problem.

The practicability of television on a syndicated basis remains one of the major issues confronting NBC. The first step in linking together a network will in all probability be taken as soon as the Washington and Philadelphia stations are completed, with programs being sent to New York, and then to Philly, through coaxial cables. Because of the indefinite state of the costs involved, the problem can't be determined until the practical tests are begun, but it is believed that an effort will be made for the 3-way tie-up as soon as possible.

Union Negotiations Up Soon

While there are some 4500 sets now in use in the N. Y. Metropolitan area, programming will continue to emphasize special events and outdoor programs. While television is still in a strictly experimental stage, and there is no income from that source at all, unions to date have not made an attempt to set up a special rate structure. As a result future meetings with all the unions involved, including talent, musicians, and stagehands (I. A.), must take place.

Opening up of new advertisers is also seen, with department stores and fashion centers among those most likely to pay the initial bills for localized advertising via the new media.

"Fantasia" Projection Procedure Data

PROJECTIONISTS everywhere will be interested in knowing some of the details relative to the preparation for and presentation of Walt Disney's terrifically successful "Fantasia" in its world-premiere theatre showing at the Broadway Theatre in New York City. That the phrase "terrifically successful" is no exaggeration is evident from the appended few details of the business being done by this Disney masterpiece combining color, music and sound:

"Fantasia" is a complete sell-out at every performance (normally two-a-day, but with extra shows on weekends and holidays), with the daily advance ticket sales averaging $8,500, and an overall advance sale of more than $65,000. Six box-offices are now in operation, while immediately following the opening 'phone service was increased from 4 to 12 trunk lines and the theatre staff was tripled.

Major domo of all visual and sound projection facilities for "Fantasia" is Cecil Wood, for 40 years a top-flight projectionist craftsman with a fine record of accomplishment at home and abroad. All the old-timers know Cecil,

(*Continued on page* 38)

New Walker Plastic Molded (P. M.) Screen Is Highly Efficient, Easily Cleaned

THE completion of a series of exhaustive tests of the new Walker P. M. (plastic molded) screen, conducted especially for the writer, enables him to state with assurance that this surface constitutes a major advance in the projection art. It not only represents a radical departure from conventional procedure in terms of materials used and method of production, but it also permits the attainment of a brighter and better-defined picture image, and it eliminates a serious maintenance difficulty.

Thus is overcome the three-headed problem of high efficiency, easy maintenance and long life—the goal of every screen manufacturer.

But the big news herein is that Walker P. M. screens, whether white or silver, *can be washed with little effort within an hour by one man and with splendid results!* More anon on this feature.

This new surface, molded of a plastic, is not flat but is smoothly contoured in a series of elliptical curves. Its surface has no seams, being molded in a single sheet in various sizes up to 30 feet in width. Instead of being perforated in the usual manner, the screen is provided with holes *molded* in the shape of flaring horns, the sidewalls of which form part of the surface contours.

This type of construction gives rise to three main considerations: reflective efficiency, sound transmission properties, and durability, or life.

The advantages of a plastic structure are many, chief among which is that it is the only suitable medium in which the aforementioned contours could be formed. Such a surface, molded in a single piece, possesses absolute uniformity from edge to edge of the entire screen, as the customary seam, with its steadily increasing visibility, is eliminated. The durability of this hard, tough structure is obvious. There are no cut fibres to absorb dirt and moisture in and around the holes, thereby eliminating a major cause of deterioration.

The open area at the bottom of the holes, through which light is lost, amounts to 8.1% of the total area. Overall reflective efficiency is 86%, including the loss through the holes. This

By *JAMES J. FINN*
INTERNATIONAL PROJECTIONIST

efficiency figure is about the peak level possible [72% being the worst figure encountered by the writer], with any screen surface, despite the circulation of numerous statements anent a higher figure which have no basis in fact.

The contour of the surface causes no sacrifice of light, as there is no baffle effect. It does improve distribution within the usable area. No disturbance of focus is caused, as even the most critical projection lens has a depth of focus several hundred times the depth of this surface.

The curvature of surface employed by Walker prevents the formation of a flat image in one plane and produces an illusion of depth by causing the eye of the observer to resolve a series of images in a multiplicity of planes. In theory, the elliptical contours of this surface should produce a different kind of picture; and in practice, this has been the result. The contoured imaging surface definitely influences the illusion of depth and the "window effect" is increased. Technicolor shows illusion at its best.

Several installations viewed by the writer showed a lack of flatness, an apparent separation of foreground and background, a reduction in consciousness of the screen. While this surface definitely does not produce a third dimension nor anything really startling, it does produce an effect of depth difficult to evaluate but which can be observed.

Sound Transmission O. K.

The smooth, hard surface, contoured in easy curves, provides no lodging places for dust and dirt. Tests indicate that this structure collects dirt at less than half the normal rate. A prime detriment to sound transmission is virtually eliminated by the widely-flaring, horn-shaped holes.

Due to the flaring sides of the molded hole the air-column load and viscosity effect common to the conventional perforation is sharply reduced. Rough ends of severed fibers and broken coating are absent in the Walker P. M. screen, having been replaced by a smooth plastic wall. The flaring-horn shape of the hole permits improved angular distribution of sound.



Angle shot showing structure of molded screen. (Enlarged 9 times actual size)

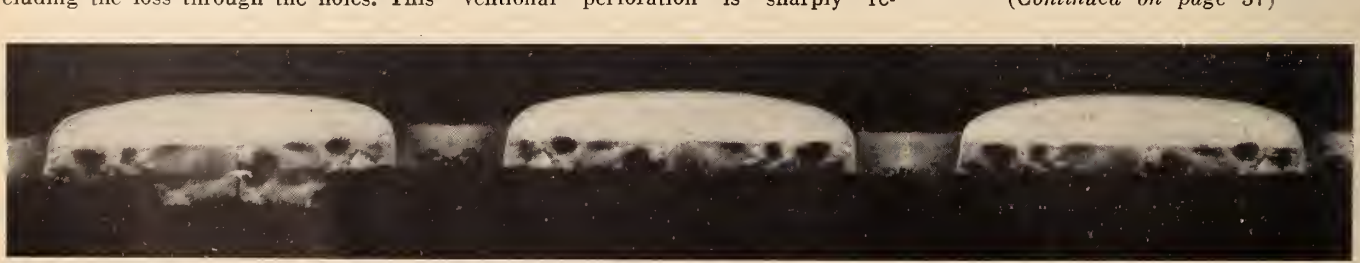
Now for the *piece de resistance*—the cleaning (or washing, if you prefer) process. Any screen surface subjected to light from a carbon arc, even glass, will ultimately break down. There are three main reasons why theatre screens deteriorate, as follows: 1, atmospheric conditions; 2, smoking in theatres, and 3, as a result of air-conditioning equipment operation.

The average theatre screen may lose as much as 50% of its original efficiency within six months. The Radio City Music Hall, in N. Y. City, estimates that its screen is "down" 40% within six months. All screens deteriorate steadily from the date of their installation, and that dirt forms on *any* screen within four months.

The best refinishing process (favored by many projection people), "pulls up" a screen from, say, 45% to approximately 65 or 70%—*but* the unclean surface still remains underneath. Also, there is reason to believe that the "zing" imparted by the refinishing process is almost wholly lost within six weeks. Refinishing, therefore, shapes up as pretty much a product of desperation.

The cleaning of motion picture screens heretofore has been wholly im-

(*Continued on page* 37)



Cross-section of Walker P.M. screen showing how plastic surface is molded in one piece over a joint in the cloth backing, forming the elliptical curves and shaping the holes. (Photomicrograph 20 times actual size)

WHAT *Century* MEANS . . .

CENTURY

Construction—Cast iron case and main frame—all in one piece. Heavy, full width cast aluminum doors front and rear. Rigid support on all sides assuring accurate alignment of all shafts. Result: a better mechanism and steadier pictures.

Economy—Low cost, long machine life, reduced power consumption, lower operating cost. The Century Projector is an engineered product that guarantees 'TOP' performance . . . always—at 'LOW' cost.

New—4 bearing intermittent movement—Direct drive, no gears inside case. Easily removed from operating side of the mechanism. This movement is an outstanding example of precision manufacture.

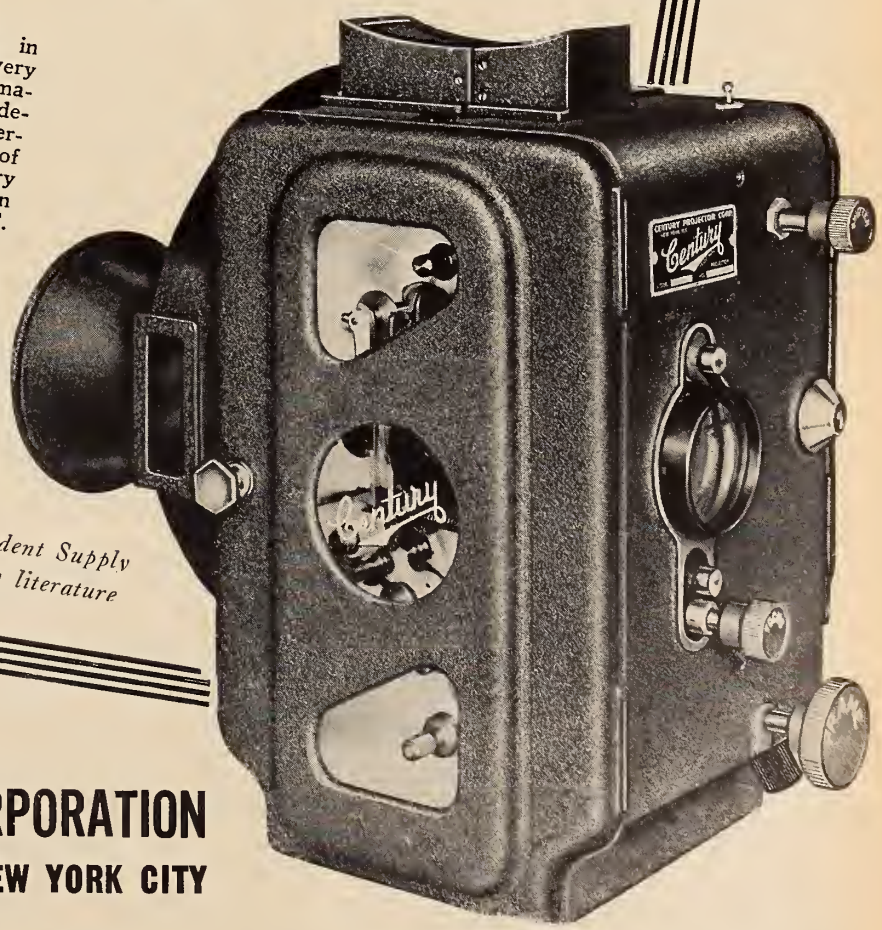
Timing of shutters, focusing and framing knobs on front of mechanism. Single Shutter—silent, smooth, dependable. More light than with any other 90° single shutter on the market. Double Shutter—encased within rear housing—advanced design gives maximum brightness, sharper focus and steadier pictures.

Unnecessary gadgets have been eliminated—Unit pad-roller arm construction eliminates exposed springs. Grease sealed ball-bearings never require lubrication.

Reflects the finest in workmanship — Every Century Part is machined to the 'nth' degree of operating perfection. The finest of materials used. Century Projectors are Proven BEST by Actual TEST.

Your Best Projector Buy! None can compare with Century. It is the result of 25 years of projector manufacturing experience plus the best engineering talent. The Century Projector is the 'Projector of the Century.'

See our Authorized Independent Supply Dealer or send for the new literature



CENTURY PROJECTOR CORPORATION

729 SEVENTH AVENUE • NEW YORK CITY

Projectionists Acclaim

THE NEW AND REVOLUTIONARY PROCESS THAT EFFECTS A

20% Saving on Carbons!

No Drilling—No Extra Work—No Dirt

More than 600 Mid-West circuit theatres—including Balaban & Katz and Minnesota Amusement Co.—have been using Droll Patented Process carbons for 2 years—with complete satisfaction.

THE Droll Carbon Process is the first such to win complete acceptance by both projectionist and exhibitor—the former because it is the only such process to render absolute safety and satisfaction without requiring any extra work; the latter because it positively saves a minimum of 20% of his carbon bill.

Droll Patented Process carbons are now available to users of the following carbon trims:

SUPREX CARBON TRIMS

Negatives	*Positives*
6 mm. x 9	6 mm. x 12
6.5 mm. x 9	7 mm. x 12
7 mm. x 9	8 mm. x 12

AND the 13.6 mm. x 22 High-Intensity, machined for adapters only.

By the Droll Process, a carbon is so drilled on one end as to make a female opening; the other end is drilled for a male opening. The projectionist need only join the carbons together and clip them with a metal sleeve of pure copper —the same as the outside jacket of the carbon.

ALL DROLL PROCESS CARBONS REACH THE PROJECTION ROOM FULLY PREPARED AND READY FOR USE.

When the positive carbon is about 3 or 4 inches long, you simply insert the next carbon in the milled-out part, slipping the copper sleeve over the stub. This copper sleeve matches exactly the copper coating on the carbon. That's all there is to it—simplicity itself.

So pronounced has been the success enjoyed by this sensational new process that we invite all projectionists to try this type carbon. It will convince you of its absolute efficiency, ease of handling—plus at least a 20% saving. Write us today.

DROLL THEATRE SUPPLY CO.

Division of J. W. DROLL COMPANY

GUS ANDERS, MANAGER

351 East Ohio St. Chicago, Ill.

Mr. Independent Theatre Supply Dealer: Where Do You Go From Here?

SEVERAL independent theatre supply dealers have advised the writer of their extreme displeasure anent certain comment pertaining to current conditions in the supply field which appeared in these columns recently. The burden of these complaints is that our comment reflects contempt of the sincere efforts made recently by a group of dealers to strengthen their position in the field, and also that it contributes to a loss of dealer prestige.

Although these correspondents don't say so directly, we assume that their pique was induced by our failure to wax enthusiastic and execute a few editorial cartwheels relative to the formation recently, by 20 dealers who met in Chicago, of the Theatre Equipment Dealers Protective Association. If this assumption be correct, we can promise our correspondents no immediate alleviation of their pain.

We could cite any number of reasons why the aforementioned Protective Association will fail signally of its avowed purpose and not mean a plug nickel to any member. However, the four reasons we will lay on the line should suffice. Let's see.

Current Set-Up's Deficiencies

First, the 20 dealers who formed the Association are lacking in number, in prestige, in competent direction and are poorly located geographically to render effective any program that is adopted.

Second, the estimated annual income of the Association, calculated on the basis of the established dues per member, is woefully inadequate to keep the members happy when the winds of competition begin howling—or, for that matter, even when competition approximating a Spring zephyr is stirring.

Third, the utter futility of the Association as a regulatory or a disciplinary body, or both, was amply demonstrated within a few hours of its formation when two moves which it initiated collapsed for want of strength and driving power. Details of these incidents are omitted herein in deference to the parties concerned.

Fourth [and this is the most serious deficiency] the Association was spawned in an atmosphere so charged with hypocricy and downright sham that, out of consideration for the olfactory organs of those present, it might far better have died aborning.

The Chicago meeting was called for the advertised purpose of rigging a defense against what were termed the "unfair practices" of equipment manufacturers and *service organizations*. [Mark well, this italicized phrase.] It was an open secret that the real, if not the only, purpose of the meeting was to devise ways and means for combating the "menace" to the dealers of current activities by the field forces of both the RCA and Altec service organizations. [RCA and Altec deny that their activities constitute any threat to the security of independent dealers, but such assurances have thus far failed to quiet the fears of the dealers.]

Now, those dealers who consumed the most time at the Chicago meeting, yelled the loudest and cried copiously were the very ones who, even as they sounded off, had already signed, or had handy in their pockets ready for signing, a contract form which provided for their voluntary active participation in practices which they were shrilly denouncing in terms of extreme bitterness. Now, anybody who can with equanimity swallow such a potion is welcome to it. We can't.

The most confusing aspect of this situation is the feverish straining on the part of the independent dealers currently to organize an association of precisely the same character as the one they so blithely consigned to the ash-can not so many months ago. We refer, of course, to the now defunct Independent Theatre Supply Dealers Association.

The Independent outfit, despite the inevitable grousing of a few congenital moochers, was the best thing that ever happened to the dealers. It had to be to endure the strains to which it was subjected by the few who could not get through their noodles the fact that the breaks had to be distributed around impartially instead of being handed out to a favored few.

Fine Record of Old Organization

The Independent Association, under the able direction of Joe Robin, proved its worth to the dealers. It cleaned up the tangled discount situation by establishing one figure in place of the four, or more, previously prevalent. It afforded group strength and protection of its members without the slightest impairment of individual freedom of action. It conducted a high-class, clean-cut advertising and promotional campaign that added immeasurably to dealer prestige; in fact, so successful was this campaign that it forced the hands of non-advertisers—which development certainly didn't hurt the sale of equipment overall.

The Association earned the confidence and enjoyed the cooperation of the trade press. One example of this cooperation was the battle waged jointly by the Association and this publication against any extension of the "electrics'" influence in this field. This was a nice job, one that was productive of splendid results—particularly for the dealers.

The Association kept its members informed of the very latest developments in the equipment field. It promoted community welfare. It enlisted Federal aid for its cause when such assistance was vitally necessary. It took the "bull" out of manufacturers' bulletins. It—well, what's the use? The best proof of the worth of the independent Association is the current frantic activity on the part of its former members to organize its exact connterpart!

The Independent Association was split asunder finally by the petty-larcenous conniving of a few dealers who, unable to hog all the benefits, were determined that their fellow-member should not enjoy the fruits of his own perspicacity and effort. Indicative of this small-mindedness is the instance wherein two large-volume dealers permitted a disgruntled solicitor for a regional trade paper to "horse" them into demanding that, since they paid more dues than certain small-volume dealers, their names appearing in the Association's ad copy should be in relatively larger type!

Break-Up of Assoc. Unwarranted

Some dealers might point to the effect of the Patman Act as largely responsible for the demise of the Independent Association. To which our reply would be that if this be true, why the sudden yearning for a dealer organization now when the Patman Act still is operative? The effect of the Patman Act should have emphasized anew the greater need for the survival and the strengthening, rather than the disruption, of the Association.

Manufacturers were not permitted to tie-in with Association activities; but it violates no confidence to reveal that just before the outfit folded plans were completed for manufacturer participation in the Association's promotional campaign to an extent that would have been productive of fine results.

Vitally needed in this field is such an organization, the existence of which would benefit all concerned, including the independent dealers' competitors, through the raising of standards all along the line and in making Messrs. Exhibitor and Projectionist conscious of the manifold advantages of good equipment kept in repair and frequently replaced.

Our contact with both dealers and manu-

(*Continued on page* 36)

L. U. 143's Residence Canvass in Manpower Dispute

Unique stunt involving a house-to-house canvass of residents of two St. Louis suburban towns was employed by I A. projectionist Local 143 in an effort to acquaint the public with Union's side of controversy with theatres which refused to employ two-men shifts. Union members act as canvassers and, covering every residence in the towns, explain to the townsfolk that a lockout rather than a strike is involved. Also, stress is placed on the fact that a neighboring St. Louis County ordinance requires two-men projection shifts.

THIRD-PARTY PICKETING O.K.

Federal courts are without power to enjoin unions from picketing third parties in a labor dispute even though alleged violations of the Sherman Act are involved, the U. S. Supreme Court ruled recently in a decision of marked interest to the film exhibition field. In effect, the decision okays secondary picketing. Case was a Chicago non-theatrical one.

Ole Man Low Is Dead (and Buried); Victim of Modern Projection Pace

YES, sir. Ole Man Low is dead, but there ain't nobody who can say that his death was in vain. Particularly distressing was the manner of his passing, for he took with him to his grave a pet theory of the projectionist craft that the very few projection-minded theatre owners and managers are those charged with the operation of the big de luxers on the various Main Stems throughout the world.

It remained for the owners of the 600-seat subsequent-run Liberty Theatre in Toledo, Ohio, to disprove the idea that there lived not a single exhibitor who did not conform to the general tendency of the motion picture industry to water the leaves (lobby display, *etc.*) and neglect the roots (good projection made possible by good equipment kept in good working order).

The names of these estimable gentlemen (what, no award?) are Robert Collins and Frank Tafelski, who certainly merit and hereby get a paragraph all to themselves.

The story goes like this: When Messrs. Collins and Tafelski decided to do a real honest-to-goodness, bang-up job of renovating their Liberty Theatre they didn't merely turn down the well-trod trail taken by practically every other exhibitor by calling in the architect and saying, "Well, Mr. So-and-So, I've got 700 bucks to spend on this place and I want you to dress it up outside and inside so that it looks like something to the customers. And, without any of this damned equipment nonsense, d'ya understand? This is strictly an outside job."

Projection First on List

Not at all. When the Collins-Tafelski team swung into its modernization stride it traversed the entire theatre and, with an acute awareness of the fact that their chief, if not their only, merchandise was the image on their screen, gave first consideration to the needs of the projection room. (What a blow to the building trades crafts and the supply houses!) Provision having been made for the Liberty's projection needs, the sign men, the painters, and the lumber companies got what was left. Almost unbelievable, ay?

The biggest bang gotten out of the entire modernization program by Messrs. Collins and Tafelski, subsequent events tend to show, was the replacement of a pair of low-intensity arc lamps with two new 19000 Series Simplex H. I. arc lamps. Now, its a lead-pipe cinch that any exhibitor team smart enough to translate good projection in terms of smart merchandising must be endowed with a rather acute sense of what constitutes good salesmanship. Figured these smart theatre operators: why merely discard old equipment in favor of the most modern units available, thereby improving our screen image tremendously to the greatly increased comfort of our patrons, without reaping some benefit therefrom? The logical answer to this question led to the ingenious conception and execution of a gorgeous theatre exploitation stunt. Lend an ear—or, rather, an eye.

The accompanying illustration really tells all, there remaining to be cited only a few of the details incident to the stunt and the results achieved thereby. In the picture note the painstaking attention to detail: the regulation size coffin the doomed low-intensity lamp reposing therein, the numerous floral offerings, the explanatory banner hung over the theatre entrance (herein lies the sock of the stunt), and last but by no means least the apparent look of sincerity on the faces of the "mourners" grouped around the casket.

Need it be emphasized that innumerable photos of this set-up were taken from various angles and planted where they would do the most good, that is to say, in the local newspapers, in the neighborhood served by the Liberty and, lest we forget, in the ever-obliging trade press?

Selling the Screen Image

The product of many minds and hands were enlisted in making of this novel exploitation stunt the great success that it was, but in the opinion of INTERNATIONAL PROJECTIONIST top honors are due and are hereby tendered to Messrs. Robert Collins and Frank Tafelski, owners of the Liberty Theatre, for (1) recognizing the paramount importance of good projection in the scheme of things motion picture, (2) resisting the hoary tradition of the exhibition field that that which couldn't be seen by the paying patron made no impression on the latter and therefore was not a factor in affecting box office receipts, and (3) capitalizing on their conviction that the public would demonstrate its appreciation for any sincere effort to improve the presentation of motion pictures by increased patronage.

So, Messrs. Collins and Tafelski, take a bow and be assured of the appreciation of projectionists everywhere. Projectionists, for their part, might induce some very interesting reactions by showing this story to theatre owners or managers and thereby pass along an idea for exploiting the installation of new equipment.

Yes, sir, Ole Man Low is dead—but he laid down his life that a 19000 Series Simplex H. I. Lamp might live and serve better the art and the craft of motion picture projection.



Yes, sir, Ole Man Low is dead—but definitely! He was O.K. when he had it, but at his age he was an easy victim to his mortal enemy, Mr. Modern Projection. Herewith view of Ole Man Low's interment services held in front of Liberty Theatre, Toledo

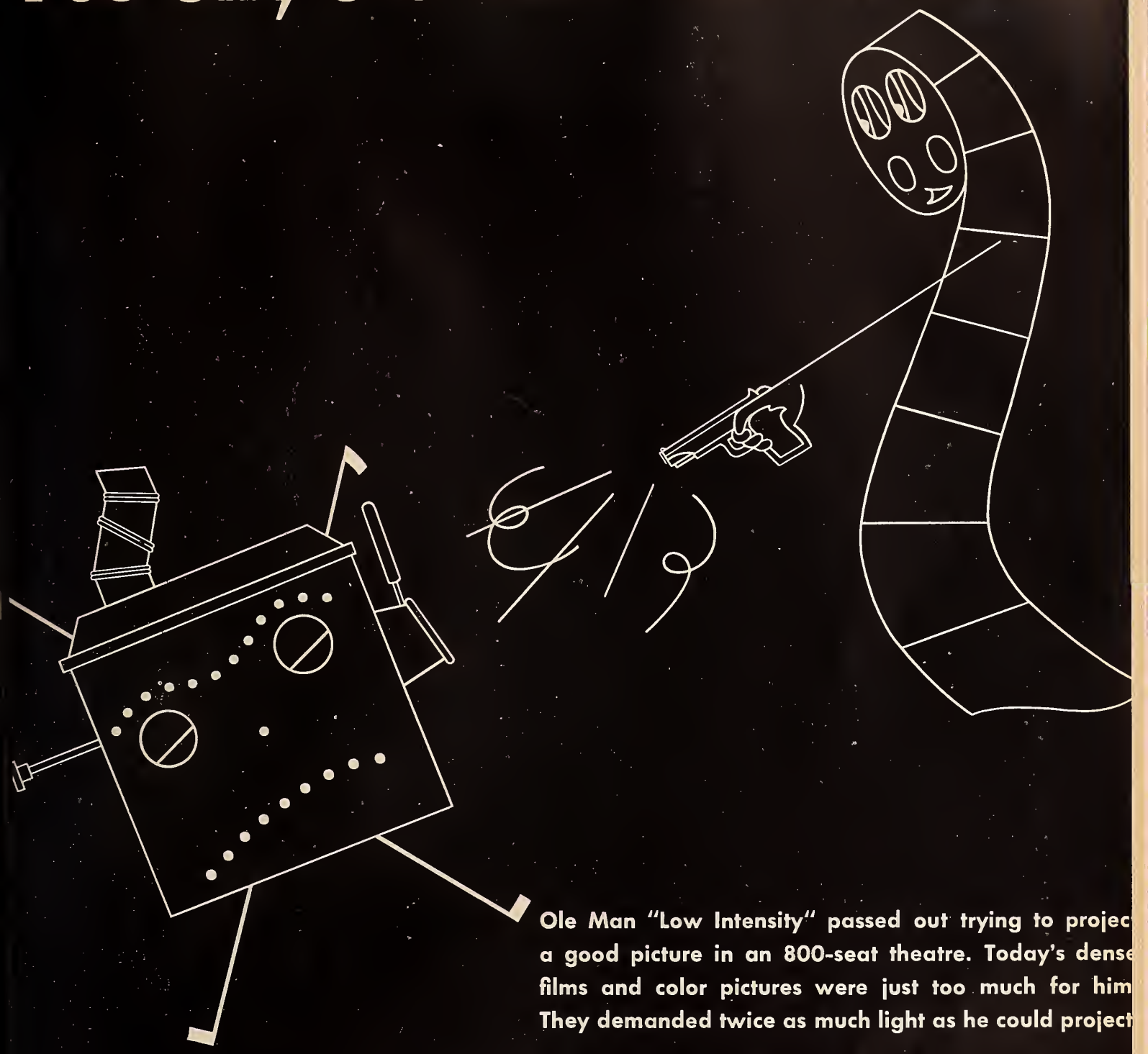
Next 'Fantasia' Stands Set

The two next "Fantasia" engagements, following its N. Y. opening, are scheduled for Boston, late this month, and for Los Angeles, early in January. Both showings on roadshow, two-a-day basis, of course. Cecil Wood, projection chief for Disney, will personally supervise all openings, on both the technical and the Labor ends.

Seek 16 mm. Ban in Minn.

A bill which would prohibit the showing of 16 mm. pictures in taverns and clubs, as well as the banning of coin-in-the-slot film devices, will be sought in the Minnesota Legislature by Allied Theatres of Northwest. Present plan calls for the introduction of such a measure when the law-makers reconvene and it is said to be the first organized campaign agaist such alleged competition. Allied members claim 16 mm. pictures are hurting patronage in regular theatres.

Yes Sir, Ole Man Low Is Dead!



Ole Man "Low Intensity" passed out trying to projec
a good picture in an 800-seat theatre. Today's dense
films and color pictures were just too much for him
They demanded twice as much light as he could project

But no one will mourn the passing of Ole Man Low
because the fine new Simplex High Projection Arc pro
duces *modern snow-white light*—the kind your theatr
needs today—for just 2c more per hour.

Your National Theatre Supply Company representativ
will show you the Simplex High in your own theatre
Ask for a demonstration and see the difference.

See the difference with the

Simplex High

Distributed By

NATIONAL THEATRE SUPPLY COMPAN

"THERE'S A BRANCH NEAR YOU"

Abnormal Operation Shortens Tube Life

By J. B. PESEK, INSPECTOR, ALTEC SERVICE CORP.

OFTEN maximum life is not obtained from W.E. 264-type vacuum tubes because of abnormal operation. The 264 tube is the D.C. filament type used in many W.E. voltage amplifiers. Short life seems to be most generally experienced at installations using power units for current supply, and to a lesser degree at installations using motor generators.

A survey made sometime ago revealed that whereas the average life of the 264 tube when properly handled can be expected to be as high as 6000 hours, the life may be cut in half due to careless handling at installations equipped with 18-volt motor-generators, and reduced still further at installations having power units.

Short tube life at these installations is due to operation for prolonged periods at higher than the normal filament current of 300 mils. Often these tubes are operated at 330 mils and higher. To assure a reasonable life from the 264 tube it is necessary that the filament current be checked frequently and readjusted by the filament control rheostat provided for that purpose. If periodic adjustment is not made the current may vary widely.

Temperature a Resistance Item

For instance, when a motor generator or power unit is first started up in the morning it is cold. The resistance of its circuits is at a minimum; the same applies to a lesser degree to the resistance of the resistors and rheostats in the filament circuits of the amplifiers. This low-resistance value means that a higher current will flow. As operation continues, the power unit or motor generator heats up and their resistance increases, which in turn, causes the current to drop. Remember that, with very few exceptions, the resistance of a conductor increases as its temperature increases.

In line with the foregoing, if, when the show closes the preceding night, the filament rheostat is left adjusted so that normal filament current flows while the power unit or motor generator is heated to maximum after being in operation all day, then when the system is started up next morning an abnormally high filament current will flow because the equipment is cold and its resistance at a minimum. If the rheostats are not readjusted, high filament current will continue to flow until the equipment heats up to the same temperature as at the close the preceding night, when the current would again become normal. This heating-up in the morning may require one, two or three hours, and during this prolonged period the tube filaments will be operating at an excessive current.

Rheostat Readjustment Required

All filament rheostats should be adjusted to provide the proper 300-*mil. current when the system is first started up in the morning.* Then, filament meters should be checked frequently and the rheostats readjusted to maintain normal current as the power supply equipment heats up. If the current is not checked and readjusted frequently during the opening hours, the current will fall off; and poor quality will be the result.

Other things to take into consideration are: always see that the meters in filament circuits read correctly; also, that the zero-adjustment of meters is correct; and the necessity for avoiding jarring or tapping the 264 tubes, which may cause damage to the filaments.

The foregoing data apply to filament current variations caused by the heating of power supply equipment. Filament current variations are also caused by line voltage fluctuations, which is another reason for frequent filament meter checks and rheostat readjustments.

HOW NOW HOLLYWOOD GLAMOUR?

The Cine Colonial in Avellaneda, near Buenos Aires, S. A., is now showing five films in a seven-hour performance for 20 to 30 Centavos, equal to 4¾ to 7 cents in U. S. coin.

New Elsco High-Power, Low-Cost Sound Unit Adaptable to Any Existing Theatre Set-Up

ONE of the most interesting developments in the sound equipment field within recent years is the new Elsco theatre amplifier just announced as ready for distribution by Larry Strong, Inc. Warranted to cover the entire present recording range of from 30 to 9000 cycles, this extremely compact unit (not exceeding one foot in any dimensional particular) produces tremendous power with minimum distortion and is suitable for theatres having up to 2000 seats. A sensationally low price of $135 has been fixed on this amplifier in anticipation of large-volume business.

Outstanding features of this new Elsco equipment, states the manufacturer, include the following:

Principal Elsco Features

Extremely compact: it is only 9½" wide, 8½" high and 8" deep, weighs only 20 pounds, and requires very little room space.

Operates on 110-volts, 50-60 cycle A. C. supply.

Will match any existing speaker equipment and will couple to any sound-head, regardless of type.

Present installations prove its ability to serve with complete satisfaction the needs of any theatre up to 2000-seat capacity.

Tube complement: two 6N7 metal tubes driving two 6N6G's and is fed by a 5Z3 rectifier. Tubes are available in any radio store.

All main condensers are of the plug-in type and are replaceable in the same manner as are tubes. Condensers replaceable without the use of a soldering iron.

Circuit used is of the inversion type and covers entire range of from 30 to 9000 cycles.

Supplies its own p. e. cell voltages, which are adjustable. Coupling to the p. e. cell is direct and is accomplished by low-capacity cables fully shielded. Supplies its own exciter lamp voltages for either 8½ or 9 volts at 4 amps.

Is equipped with gain and tone compensation.

Changeover switch is incorporated.

Installation should not require more than one hour, it is indicated by experience in this direction to date.

Extensive Tests; Portable Unit

Reversing the usual procedure, the manufacturer of this new Elsco unit followed up his own laboratory tests with extensive and exhaustive trials in 25 Mid-West theatres having diverse physical and operating characteristics. The results of this trial are said to have sustained every claim made for high-grade performance by the equipment. Additional installations are now being made on back orders, states the distributor, who expects to have nearly 100 units operating by the first of the year.

The extremely low cost of the Elsco amplifier has contributed greatly to an unexpected development wherein most theatres are able to order two units simultaneously, thus affording maximum protection to a theatre in the form of an instantaneous emergency switch-over setup.

For service work, as well as for theatre circuits, which require a compact unit of great power than can be hooked up speedily, there has been made available a truly portable Elsco amplifier having exactly the same characteristics as the permanent model previously described and which, contained in a metal carrycase, weighs only 26 pounds overall.

Complete details anent Elsco amplifier units is available from the distributor, Larry Strong, Inc., 1241 South Wabash Ave., Chicago, Ill.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

IN many of the larger rooms where the rewind table is located at the further end of the room, the projectionist finds it difficult to check the arcs without leaving the rewind, and frequently this has to be done at the wrong time when checking film. A simple warning signal can be made attached to the relay armature of the arc control. Drill a small hole in the end of the armature where the contacts are located and insert in this hole a clapper from a cheap electric bell; then mount the bell adjacent to the clapper so that on the movement of the armature the bell will be struck.

This can be arranged so that the bell will be struck when the carbons are either too far apart or too close, whichever is desired. Or, two different size bells can be mounted so that the two tones can be used for close or open warnings.—H. R. DAVIDSON, RCA, *Atlanta, Ga.*

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In case of a lower failure where an Erpi 12-B rectifier is in use, the power supply switch on the unit should be *immediately* turned to either "off" or "1" position and not turned to the "2" position until the 314-A tube has warmed up after the power is restored.

The use of a "No-Voltage Release" type magnetic contactor is recommended where power supply conditions result in extreme variations and frequent failure of supply voltage.—C. J. FAULSTICH, RCA, *Jacksonville, Fla.*

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In projection rooms where local house phones are used, it is possible to automatically cut off the monitor when phone is used by bringing one side of the monitor voice line to phone and connect contactor in series with same. The contact "make" and "break" is actuated by the receiver hook.—H. E. FRISBEE, RCA, *Pittsburgh, Pa.*

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The old tough job of using sandpaper and time to seat motor brushes of a motor-generator set can be eliminated by using a compound called "Brush Seater," obtainable from the Ideal Commutator Dresser Co., 1251 Park Ave., Sycamore, Ill., or their distributors. This compound comes in a block 4¾" x 1⅛" x ⅝", and can be cut to the size of a brush.

The method of using on W.E. m.—g. Erpi sets has been as follows: Install brushes on one side and insert brush-seater up each brush holder on other side. Hold seater material against commutator until it starts to cut. Then remove brushes and clean. Repeat on opposite side. The seater compound will not stick to metal. This method is quick and makes a beautiful job on the brushes. After brushes are seated in this method, no arcing or noise has been found to ensue.—H. M. MADISON, RCA, *Hollywood, Calif.*

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To repair a broken flexible motor coupling, obtain a piece of high-pressure hose with a ½" hole in it, with four or five layers of fabric moulded in the rubber (this hose used on high-pressure sprayers for citrous trees) and cut a piece the length of the coupling. This is pushed on the motor shaft and soundhead shaft and clamped with proper size hose clamps. This makes for a very neat job and a perfect emergency coupling.—C. L. SWINNEY, RCA, *Atlanta, Ga.*

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A case was recently encountered where uneven take-up action was corrected by using sandpaper to improve the seating of the fibre disc. This was done by removing the take-up and inserting a circle of sandpaper, cut slightly larger than the friction surfaces, between the fibre disc and the adjoining clutch face. The pulley was then rotated by hand, causing the sandpaper to remove all high spots from the fibre and forming a perfect seat.—J. D. STEELY, RCA, *Pittsburgh, Pa.*

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Western Electric 702- and 705-type faders can be made to operate very smoothly and quickly by bending up the detent roller arm so it does not contact the detent plate. As the roller arm is not electrically connected, contact resistance will not be affected.—H. I. HULTGREN, RCA, *Springfield, Mass.*

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Persistent "speeding" of KS-motors which do not respond to the usual treatment of commutators and brushes, may be due to trouble in the 709-C control cabinet. A quick check can be made by measuring the voltage between terminals 3 and 4 on the 709-C with the motor running. If the voltage is less than 100, look to the 29.5 mfd. capacitor, trouble with which may be breakdown of the case.

In looking for background noises and interference in sound systems, don't overlook the arc feed control motors. Even modern D.C. lamps are sometimes guilty, if brushes or commutators be neglected.—K. P. HAYWOOD, RCA, *Pittsburgh, Pa.*

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If a hum should develop in an equipment using a TA-7276 power unit, due to a partially defective filter condenser in a p.e.c amplifier or 41 amplifier circuit, and no spare is available, the filter condenser in the speaker circuit can be interchanged with the condenser in the amplifier circuit temporarily. The defective condenser will cause far less hum in this part of the equipment, and an emergency may be thus alleviated.—S. B. EPSTEIN, RCA, *San Francisco.*

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In the KS-5161 type motors, the oil hole in the front bearing is several inches from the hole in the protecting screen mesh. The difficulty of oiling this bearing without spilling it over the outside can be overcome by first placing a soda fountain straw through the screen into the bearing oil hole and dropping oil down the straw. —W. J. STRIEBY, RCA, *Hazelton, Pa.*

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Every once in a while a sound system failure is encountered which apparently clears itself within a short time. Often amplifier filter condensers are suspected, that is, the possibility of short-circuited condensers healing themselves after the amplifier has been turned off. Here is a good way to check filter condensers in such instances:

Remove all tubes except the rectifier tube. Then turn on the amplifier for several seconds, resulting in the filter condensers being subjected to a higher than normal potential. If one is weak, it will probably break down; it can then be detected and replaced. The reason for the higher than normal potential, of course, is that the removal of the other tubes also removes the load these tubes normally impose on the rectifier and filter bank; consequently the potential goes up.

Caution: apply this test for only a few seconds, because there is no sense in subjecting the filter condensers to excessive voltage any longer than necessary.—L. J. PATTON, Altec, *N. Y. City.*

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Here's another stunt to remember. I

answered a trouble call and found the spring broken which holds closed the pad roller of the takeup sprocket. The projectionist was getting along fine on an emergency basis by using a rubber band to hold the roller closed.—C. W. HILLIARD, Altec, *Newark, N. J.*

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More *Popular Mechanics* ideas. The toggle on the end of the takeup reel shaft, used to hold the reel on the shaft, had broken off. While awaiting my arrival with replacement parts the projectionist was getting by with little inconvenience by using a paper clip to keep the reel from sliding off the broken shaft.—E. J. TOWNSEND, Altec, *New York.*

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Here's a real case of *low voltage*: a theatre reported that voltage on the motors was so low that the "Sentry Safetys" dropped. Upon arrival I found that the voltage to all room equipment had dropped to 60 across the 115-volt feeds, and to 160 across the two-phase circuit. Tracing backward from the room showed that the ground return on the grounded bus of the main distribution panel was burned loose from its soldered lug, thus giving an unbalanced line. Proper voltage was *temporarily obtained on an emergency basis* by using the conduit for the ground return.—WM. C. GOODWIN, Altec, *Philadelphia.*

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Last month Altecman G. H. Miller pointed out that an old KS-6684 exciter lamp rheostat could be substituted for a W.E. 708-A control cabinet, in case of failure of the latter, and made an ideal method of controlling the speed of the drive motor in an emergency. However, Mr. Miller cautioned that the exciter lamp rheostat will heat up to a dull red color and therefore must be adequately protected from coming into contact with anything inflammable.

Here is a method I used during an emergency call recently which goes Inspector Miller one better. I used an exciter lamp rheostat as he proposed but, to keep it from overheating, I submerged it in water. In this manner the rheostat will serve indefinitely. A better idea is to submerge it in oil. Either water or oil will conduct away the heat from the rheostat and prevent it from burning up.

For those who do not recall the details of Mr. Miller's item in last month's issue, the rheostat is connected across the leads from the motor, which normally go to terminals 3 and 4 of the 708-A Control Cabinet. The motor speed is then set at 1200 RPM by adjusting the rheostat.—E. G. HEMENWAY, Altec, *Binghamton, N. Y.*

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A very easy and accessible arrangement for keeping a constant check on 866-A rectifier tubes in the power amplifier of the RCA P.C. 92, and similar models utilizing these rectifiers (especially where they are arranged close to the floor) is to place a standard mirror switch plate having a round opening in the center which just nicely fits over the tube sockets. A little glue on each end will keep them in place. The filaments, as well as the blue glow, are very discernable from a standing position.—A. J. SEELEY, Altec, *Syracuse, N. Y.*

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If an emergency situation ever requires that you tinker in an amplifier with a soldering iron, use solder sparingly. And after you finish, check every hidden crevice and corner of the amplifier for stray drops of solder. Unless one is very careful when applying solder to a connection or joint, some of it, when hot, will drip off unnoticed and may drop into some vital part causing a ground or short-circuit.

Altecman J. B. Catterall, Cincinnati, had a case of intermittent noise last month and found the trouble to be a small piece of solder lodged between the wafers of a tube socket in an AM-1000 amplifier. And the month before, Inspector R. P. Egry, Pittsburgh, had a similar case of crackling noise which was traced to a drop of solder "shorting" four or five turns of a filament rheostat.

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Some people with twisted minds apparently don't think that deaf people have enough trouble. They delight themselves with pranks to make the lot of the afflicted more difficult. The other day I answered what I understand to be the fourth trouble call from theatres in the Chicago area reporting that the hard-of-hearing equipment was not operating. Troubles reported were no sound and low volume.

Investigation disclosed that the speech output wires of the hearing-aid system were short-circuited. In each case someone had deliberately cut the wires at one of the seat jacks, skinned back the insulation and twisted the two sides of the circuit tightly together forming a direct short-circuit.—STEVE WELSH, Altec, *Chicago.*

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On a recent trouble call occasioned by hum in reproduction on one machine (Simplex System), I found the stiffening web of SH-2033 Sound Bracket Assembly, which unit is normally insulated from SH-1000 sound mechanism by the six SN-158 Paraprene Bushings, made contact with the sound mechanism evidently due to casting defect. Removing sufficient metal to afford clearance, eliminated the trouble.—F. B. EVANS, Altec, *Atlantic City, N. J.*

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These stories get monotonous, here it has happened again. Recently a Brooklyn theatre's emergency call concerned a W.E. 43-A amplifier that was inoperative and was emitting smoke.

Upon checking into the amplifier I found that a "water-bug" had apparently started to walk across the bottom of V-2 socket. In the course of his walk his front end landed on the plate contact while his rear end still was dragging across the socket casting; result: ground and short-circuit.

After cleaning away the carcass, the amplifier operated normally.—SHORTY SIEGEL, Altec, *Brooklyn.*

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Recently a trouble call from a theatre reported that neither projector motor would run. The line fuses were reported to be O.K., but the 110-volt circuit was dead.

Before I could reach the theatre the projectionist had got the show going by running an extension cord from another power circuit to the fuse boxes on the sides of the Universal Bases. This is a good stunt to remember because situations of this nature are not infrequent in old theatres which are always having 110-volt power circuit troubles.—G. W. SCOTT, Altec, *Chicago.*

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Existing asbestos covered flexible cables to the carbon holders in the Ashcraft Suprex Arc Lamps are liable to breakage at a point about 2" from the holder.

It is well to check these often and rewire them with a more flexible type of cable in order to anticipate failure.—C. C. CURRAN, D.S.E.L., *Halifax,* via Altec.

Iowa Seeks New Code as Check on Many Theatre Fires

A State Fire Code which would include separate provisions covering theatre houses will be sought at the 1941 Iowa Legislature, it has been announced by Fire Marshal John Strohm. The marshal pointed out a lack of present statutes covering theatres and cited the fact that at least six theatres have had serious fires so far during 1940 as cause for more drastic laws.

Strohm said he was contacting various officials of the theatre groups to work out planned legislation which he will present to the legislature. Under present plans the state code sought will be drafted after the model code prepared by the national fire board.

The fire marshal said the action was aimed particularly at the poorly-constructed houses which are found in some of the smaller communities. He stressed that little fault could be found with the more modern theatres. One of the most commonly found fire hazards, he said, was the lack of projection rooms in some of the houses, or flimsily-constructed booths.

OPTICS AND WHEELS BOOKLET

The story of artificial light, starting with the primitive torch, going on to the flickering kerosene lamp which the automobile first adapted from the horse-drawn carriage and leading up to the sealed-beam headlight, one of the very latest in the many efficient automotive developments, is told in Optics and Wheels, the most recent of a series of research-type booklets published by General Motors.

Its pages show how the scientific facts of optics and light have been applied to solve the problem of safer night driving through the development of the sealed-beam headlamp—a cooperative project undertaken jointly by the automobile industry, lamp manufacturers and highway safety groups.

Free copies obtainable from Dept. of Public Relations, General Motors Corp., Detroit, Mich.

NEW MOTIO. W. VA. DEALER

The Charleston Theatre Supply, 506 State St., Charleston, W. Va. has been named as authorized distributor of Motiograph projectors and Mirrophonic sound systems in the Cincinnati film territory. N. E. Mehrie, owner, has been a theatre supply dealer for the past 20 years.

Excessive Greasing A Prime M.-G. Maintenance Problem

[Appended communication from Joe Robin, distributor of Robin-Imperial Steadpower motor-generators, should prove of interest to motion picture projectionists.]

A recent factory report anent an m.-g. set submitted for general overhauling elicited the following statement from the repair department: "In all our experience we have never seen any m.-g. set or motor which had been so excessively greased as this particular equipment. Not only was the inside of the driving motor half-filled with grease, but the generator fields and interpoles were buried in grease almost out to the commutator end.

"The grease removed from the commutator alone weighed 3½ pounds—about 56 times the normal amount required for one bearing! Evidently, in error, a pressure gun had been used to keep pumping in the grease. The carbon brushes were of an unidentifiable make, of a size totally unsuited for this class of service. Their use caused poor regulation and excessive commutator wear.

Extreme Corrective Measures

"To place this set in serviceable condition the following work was required: entirely disassemble; thoroughly cleanse all parts; replace both bearings (new Imperial sealed-type used); reinsulate, dip and bake both armature, field, and interpole coils; true, undercut and polish commutator; replace carbon brushes; readjust brush holders and rocker arm for neutral point of commutation; and, finally, subject to test under load for a period of time twice regular duration to determine performance and fitness.

"The failure of bearings was due to over-greasing; while the excessive commutator wear resulted from the use of improper brushes and lack of ordinary care.

"Careful lubrication once a year, combined with cleanliness instead of carelessness, will insure maximum efficiency of any m.-g. set. Apparently it is necessary to foolproof maintenance as well as operation to attain this goal."

New Luckiesh Book On Light

The fascinating story of man's conquest over darkness—literal and figurative darkness—is dramatically told in a new book, "Torch of Civilization," by Matthew Luckiesh, director of General Electric's Lighting Research Laboratory. [G. P. Putnam's Sons, New York; 296 pp., $3.] Although it is so written as to hold the interest of the average high school student, this book contains much to capture the imagination of the average adult.

In this, the twenty-first of books (relating to light, sight, color, health, etc.) written by Luckiesh, the author rises to his fullest stature as a writer-scientist. Viewing light this time in its broadest sense, Luckiesh takes the reader on many a sally into such realms as mythology, religion, philosophy, history, physiology and biology.

Torchbearers of the Art

Inspirational are the dramatic little journeys taken and tributes paid to torchbearers who have illuminated the path of civilization's progress. To straighten out warped senses of proportion, Luckiesh in his new book walks you out into the night, there to ponder the mysteries of will-o-the-wisp and lightning bug. Touching upon the ancient concepts of light, he dips into Greek mythology and recounts the legend of Prometheus snatching fire from heaven for the use of mankind.

Leafing through the Holy Bible, the author points to light, symbol of good, and to darkness, the symbol of evil. Communing with Nature, Luckiesh sees science paralleling artificial lighting with Nature's plan. As a striking example, he sees much in common between the play of northern lights—Nature's spectacular aurora borealis—and the "cold" luminous vapor of the new fluorescent lamps.

Sixteen Dramatic Chapters

"Torch of Civilization" is divided into sixteen chapters, each of which is illustrated with an intriguing theme photo. Included in the chapter titles are: Dramas of Light; Swift and Silent Light; Mankind Comes Indoors; Flaming Sources; Modern Science Evolves; Fluorescent Sources; Light and Sight; Painting with Light; and, Challenging the Sun. Other chapters are devoted to the eras of gas flames, mantles, filament sources and luminous vapors.



This Christmas—be o portner in o great life-saving compoign. Use plenty of Christmos Seols on your letters ond packoges. They ore gay, colorful . . . and what's more important . . . they spread o message of Tuberculosis control and prevention that is vital to the good heolth of us oll!

Since 1907, the onnual sale of Christmas Seals has done its share in helping to reduce the deoth rote from Tuberculosis by 75%! Complete eradicotion is now in sight! But no one is safe from Tuberculosis until *everyone* is safe. So help yourself—by helping others!



NEW LOW-COST RCA SYSTEM FOR SMALL-THEATRE OPERATION

A new motion picture sound reproducing system especially designed to meet the needs of the small-theatre operator at a price within his reach, has been announced by RCA Photophone. The system, known as the PG-134, provides in standard equipment many features heretofore confined to systems designed only for larger theatres.

This new system incorporates soundheads equipped with the famous Rotary Stabilizer mechanism. Its amplifier has high-fidelity frequency response and adequate reserve power. The loudspeaker system is of the well-known two-way type and is designed for minimum backstage requirements. The treble tones are reproduced by a cellular horn, while the bass tones are handled by a large folded baffle.

ELECTRICAL PHOTO PROCESS SPEEDS DEVELOPMENT

A new method of photography, in which the image is recorded electrically instead of chemically and from which prints can be produced immediately without the usual development, is the subject of Patent 2,221,776, just granted to Chester F. Carlson of Jackson Heights, L. I., states a Science Service dispatch to the *N. Y. Times.*

One part of the process is exactly the same as the old stunt of rubbing a fountain pen on one's coat sleeve and picking up bits of paper with the electrical charge produced.

In the Carlson process, the camera lens forms, in the usual way, a light image. This is not on the customary plate or film but on a material that is "photo-emissive," that is, it gives off electrons where the light falls. Immediately behind this is a sheet of some film, such as cellophane, and then a metal electrode, connected to an electrical circuit so as to draw the electrons to the cellophane, which then becomes charged in the electron-bombarded areas.

Post-Exposure Procedure

After exposure, the film is drawn into another chamber where it is sprayed with ink from an atomizer or dusted with a fine powder. This sticks to the charged areas, and the picture appears. For protection and to make an opaque print, the film is fastened to a sheet of paper or a card.

The system is especially adapted to reproducing drawings, typewriting, etc., but it can also be used for X-ray pictures and other kinds of photography. In such applications, the advantage would be that a permanent print could be obtained almost instantly.

EDITORIAL IN MINIATURE

One has to hand it to those fellows on the Research Council of the Academy of M. P. Arts & Sciences. Their contributions of *practical* worth to the industry during the past year far exceed the combined efforts of all other "helpful" organizations during the past ten years. Sure they've made their mistakes. Haven't we all?

They Have What it TAKES

...PROOF

Forest power conversion equipment has a proved background. Dependability, serviceability and economy are features that can't be matched. Only Forest Dry Disc Type of rectifier uses the P. R. Mallory rectifying units—EXCLUSIVELY. Only Forest LD 60 Bulb Type Rectifier has an amperage range of from 30 to 60 amperes. Only Forest can claim a constant high rating of efficiency.

These Forest 'ONLYS' only top the long list of outstanding features that give Forest Rectifiers WHAT IT TAKES . . . PROOF.

FOREST Super MAGNESIUM COPPER SULPHIDE RECTIFIERS

are the proved means of supplying DC source of current to the projection arc. Super MCS Rectifiers are all metal in construction, contain no fiber or bakelite insulators and no moving parts. They are entirely noiseless in operation and produce no radio interference. They are immune to projection room heat factors.

An important feature which places the Forest MCS Rectifier above all others made, is the newly developed Forest Transformer which guarantees protection against line voltage fluctuations.

The Super MCS has: reliable 3-phase fan, visual 3-phase line indicator, magnetic switches, automatic voltage regulator, and is approved by Underwriters Laboratories.

FOREST LD — 60 BULB TYPE RECTIFIERS

are the products which meet the demand for a reliable, efficient, low-cost power conversion device to supply projection arcs. These Bulb Type Rectifiers conform to the standards required for modern projection. Important new circuits have been developed. Each rectifier has an output from 30 to 60 amperes. When combined with the Forest Lamp, the LD 60 can be operated for either Suprex-Simplified High Intensity, Intermediate High Intensity (One Kilowatt), or Low Intensity. It is the ideal product for the smaller theatre where an inexpensive source of white light is paramount.

FOREST RECTIFIERS IMPROVE THE QUALITY OF THE PICTURE ON THE SCREEN . . . Send for literature or ask our authorized dealer for particulars . . . Also investigate the advantages of installing FOREST 'Universal Trim' LAMPS.

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MR. INDIE SUPPLY DEALER: WHERE TO FROM HERE?

(*Continued from page* 29)

facturers, personally and through the mails has made us aware of the keen desire on the part of many well-intentioned and deadly-in-earnest dealers to form an organization patterned upon the old Independent Association. Also, it is no secret to us, no less than to many dealers and manufacturers, that Joe Robin has been approached repeatedly on the score of his reassuming his former post at the head of such an organization.

To all such overtures our reaction is invariably the same as follows:

A Blueprint for the Future

"Get a fellow like Joe Robin back in the saddle. If not Joe (for what reason we don't know) then somebody else who knows his stuff. To such a fellow delegate sufficient authority to do a good job. If the fellow chosen flops, then fire him and get somebody else.

"Get a few bucks up on the line so that your organization won't have to operate in a back room. You independent dealers afford a few bucks for such a purpose but you will get it back several times over. Once you get your outfit organized and rolling, get behind it with everything you have. Stop chiseling on both your fellow-dealer and on the manufacturers. Make the manufacturer toe the line, as per promises made. Stop politicianing and conniving. Get out and do an honest-to-goodness, full-day's work."

This statement still goes.

The dealer organization formed at the recent Chicago meeting does not, cannot satisfy the exigencies of the situation now prevalent in the supply field. Its decrepitude, within two months after its formation, is apparent to all. Its interment should take place promptly and inconspicuously.

If the independent dealers really mean business in this direction, they could do themselves no greater favor than to revive immediately the Independent Theatre Supply Dealers Association and thus obtain the protection and the aid that they seem so ardently to desire.—J.J.F.

3RD DISTRICT BOSTON MEETING

Representatives of 53 Local Unions attended the regular semi-annual meeting of the I. A. Third District held in Boston, Mass., Dec. 1. Vice-president James Brennan presided, and Fred Newcomb acted as secretary. The session was of unusually brief duration, the few comparatively minor matters up for attention requiring about 2½ hours overall.

A resolution of sympathy anent the death earlier this year of District Representative John Gatelee, member of L. U. 186 who had served the I. A. in many important posts, was adopted by the delegates and provision made for its presentation on a scroll to Mrs. Gatelee. The next District meeting will be held in Springfield, Mass., on the anniversary of Gatelee's death, and will be marked by the placing of a wreath upon the grave of the deceased labor leader.

NEW WALKER P.M. SCREEN

(*Continued from page* 26)

practical because of the simple yet controlling reason that streaks resulted due to the inability of any known process to remove all the dirt that was embedded in the surface of the sheet. In addition, the dirty cleaning fluid would run down the screen surface and be trapped by the short corners .of cut perforations.

The Walker Cleaning Process

In the Walker P. M. screen, the plastic forming the walls of each hole extends in a thin ring through to the very back of the screen where it is thoroughly sealed, thus eliminating any concern anent sharp corners of cut perforations. The writer witnessed the cleaning of several Walker P. M. screens *installed in theatres.* Here's how it goes:

First, it is necessary to obtain a DuPont cellulose sponge and the special Walker Screen Cleaning Fluid. The latter is a blue fluid, the contents of a gallon can of which will clean an average-size screen of 12.9 by 17 feet. It will not clean any other type of screen.

The entire gallon of Walker Cleaner is dumped into a bucket. No water or other addition is required. Starting at the upper left-hand corner of the screen and working from the top down, the worker cleans the screen in overlapping sections of 3 or 4 square feet. After cleaning this area, the sponge is soaked in the bucket, and then the excess fluid is squeezed out. Then, with downward strokes, the cleaned area is wiped dry for the first time. Again the sponge is rinsed in the bucket and squeezed dry, following which the cleaned area is again wiped dry.

Thus, the cleaning operation for a given section consists of *one* cleaning motion and *two* wiping motions, the latter one of which should leave the surface dry.

The worker then moves to the next similar-size area and repeats the identical process. Naturally, it is important that both the cleaning and wiping motions overlap between adjacent sections. No protection for the masking is required except for a few strips of newspaper at the bottom. If a screen be very dusty, both the surface and the backing should be brushed before cleaning.

The Walker P. M. screen is a plastic of sufficient hardness, smoothness and thickness to keep dirt *on,* rather than *in,* the surface, and its smoothly flared

S.M.P.E. ROCHESTER MEET

The Spring, 1941, Convention of the Society of Motion Picture Engineers will be held in Rochester, N. Y., May 5-8, with headquarters at the Sagamore Hotel. Meeting will overlap by one day the convention of the Acoustical Society of America.



A Message to Projectionists

As another year comes to a close, and a new one begins, I would like to express a word of appreciation to all you projectionists who have shown our Altec inspectors the friendly cooperation that our men tell me they receive from you. It is particularly gratifying to know that in a great many cases this team work, over the years, has ripened into personal and family friendships. Friendship, backed by confidence, means progress in the development of national unity, and will directly contribute to future advancements in the motion picture industry.

R. W. Garrow

PRESIDENT

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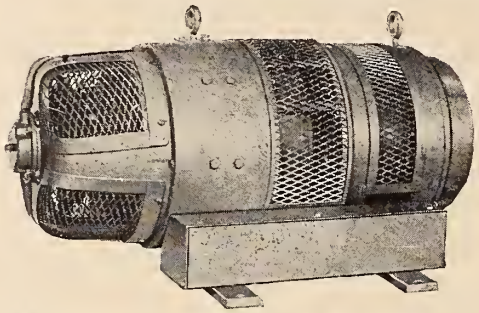
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Ninety years of electrical and motion picture experience are built into the Robin-Imperial Stedypower motor generator, used wherever pure D. C. power is required. There is no substitute for experience, just as there is no substitute for generated D. C. power.

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There is a Robin-Imperial Stedypower generator available for every type of motion picture projection arc lamp service, including multiple types rated at 36-42-60 volts for all Suprex arcs—whether the 1 K. W. or the standard Suprex types. The same generator unit will also supply current for spotlight operation.

Robin-Imperial Stedypower generators are distributed through Independent Theatre Supply Dealers, who will be glad to serve your every projection need swiftly, efficiently and courteously. On your next visit to your Independent Dealer ask for details concerning the Robin-Imperial Stedypower generator—the projectionists' favorite D. C. power source.

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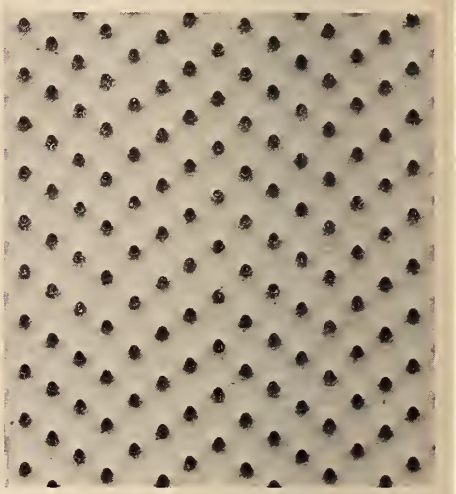
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curves which eliminate sharp corners enable the cleaning sponge to reach the entire surface area.

It is important that no molded screen be permitted to get very dirty, and there is no reason why it should when the cleaning process is so simple. The Walker P. M. screen should be, and can be, cleaned three times annually, to maintain maximum efficiency. On this basis the screen should function efficiently for 4 years. Currently the average life of screens is eight years, thus illustrating the conservatism of the foregoing rating.

Fine Results Easily Had

The Walker cleaning process appeared to the writer to be as simple as cleaning a bathtub, and with similarly effective results. Cleaning a silver



Walker P.M. screen structure, actual size

screen seems fantastic, but the writer saw a Walker P. M. silver sheet cleaned just as easily and effectively as was a white screen. Such a job was the Palace Theatre, Bethlehem, Pa.

Payoff of the cleaning process is that the writer witnessed the cleaning of a 12.9-by-17-feet sheet in the 72nd St. Newsreel Theatre in N. Y. City by one man (a member of the regular staff) in 43 minutes. Examination of the screen surface immediately following the cleaning, as well as on several subsequent visits to the theatre both prior to and during performances, served to substantiate every claim made the efficacy of his cleaning process.

This much having been said, there remains to be added only that Mr. Walker has something in his new P. M. screen—and how!

'FANTASIA' PROJECTION DATA

(*Continued from page* 25)

and those who don't know of him are referred to the biographical notes accompanying his likeness elsewhere in this article.

Cecil's first move was to go out and spend a mere $8,500 for new projection equipment, including 3 Simplex

E-7 projectors and 3 new McAuley 125-ampere high-intensity lamps. [Ed's Note: Not much is known about this new lamp, due, no doubt, to Mac's retiring disposition and well-known passion for anonymity.] Naturally, with heads and lamps for a starter, Cecil went whole hog and bought all the trimmings that go to make up a first-class projection room. And, as Joe Robin would say, we mean first-class!

Mindful of the painstaking attention necessary for a set-up that utilizes 36 speaker units on the stage plus 22 small cabinet-type speakers throughout the auditorium, Cecil naturally made sure to obtain adequate manpower. As finally worked out, the labor contract called for 10 men, with 3 men on a shift for each showing, on a roadscale basis. Of course, the total crew number of ten reflects the share-the-work policy of Local 306, N. Y. City, where four days is the maximum permitted in the better theatres. Under the N. Y. City set-up the maximum average work week per man on "Fantasia" is 10 hours.

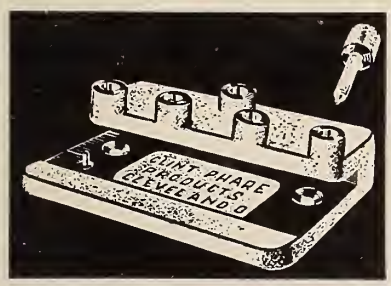
For the first month of the N. Y. City run of "Fantasia" the Broadway Theatre is on daily sound system service, starting two hours before showtime and necessitating the presence of standby manpower from the shift scheduled to run the first show each day.

8-Section "Fantasia" Print

The "Fantasia" print consists of 8 different subjects, with no reel exceeding 1600 feet in length. Operating procedure is reminiscent of Vitaphone days in that the use of separate heads for both sound and visual prints necessitates starting both prints simultaneously at precise starting marks. Naturally, both heads are interlocked and operated by means of Selsyn motors. A section of the "Fantasia"

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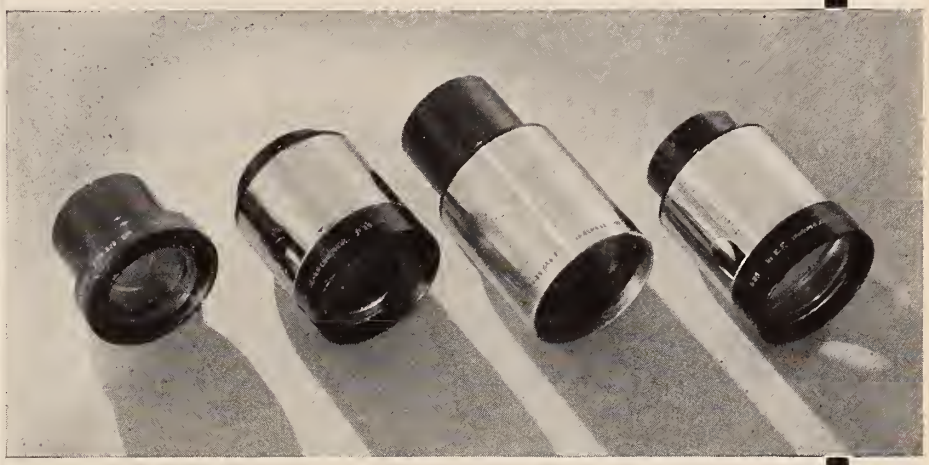
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The result of this increased light on the screen is a marked gain in contrast and crispness. Shadow detail is not diluted by distributed light. Color films have greater purity and brilliance.

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Exclusive Manufacturers of the Transverter

sound track is reproduced in this article.

Changeovers on "Fantasia" (all fade-outs, of course) are unorthodox in that they are accomplished by means of the superimposition on the print of a piece of white leader which, when it hits the gate, results in a distinct sharp "click" audible all over the projection room. The E-7 tension springs are ideally suited for this purpose.

Thus far 7 different complete prints have been used during the New York run, but, lest we slander the L. 306 boys, we hasten to add that this reflects Cecil Wood's desire to use the Broadway Theatre set-up for making up in perfect order sufficient prints for the "Fantasia" runs in other cities.

N.Y. Critics' Estimate of 'Fantasia'

Probably the most penetrating reviews of "Fantasia" were those of the music and the motion picture critics of The New York Times. *The appended excerpts from these reviews will convey to projectionists an idea of how this Disney effort was received generally.*

By BOSLEY CROWTHER

N. Y. TIMES MOTION PICTURE CRITIC

MOTION-PICTURE history was made at the Broadway Theatre last night with the spectacular world premiere of "Fantasia." Mr. Disney has this time come forth with something which really dumps conventional formulas overboard and boldly reveals the scope of films for imaginative excursion. Let us temperately admit that "Fantasia" is simply terrific—as terrific as anything that has ever happened on a screen.

Mr. Disney, together with Leopold Stokowski and the Philadelphia Orchestra and a corps of sound engineers, have fashioned with music and colors and animated figures on a screen a creation so thoroughly delightful and exciting in its novelty that one's senses are captivated by it, one's imagination is deliciously inspired.

Vast and Spellbinding Range

They have taken eight symphonic numbers which are generally reserved for the concert halls, let Mr. Stokowski's orchestra record them on multiple sound tracks, and have then given them visual accompaniments of vast and spellbinding range. In brief, they have merged high-toned music with Disney's fantastic imagery.

What the music experts and the art critics will think of it we don't know. Probably there will be much controversy, and maybe some long hair will be pulled. Artistic innovations never breed content. But for this corner's money—and, we reckon, for the money of any one who takes it in the blithe and wondrous spirit in which it is offered—"Fantasia" is enchanting entertainment. This is one time, we warrant, you won't want to listen to music with your eyes shut.

For, as mentioned, you need not expect the customary collaboration of film and music. From the beginning it is obvious that this is a visual concert, with Mr. Deems Taylor participating as commentator. It is, he explains, a representation of "designs and pictures and stories" which the selected music has inspired in the minds of a group of artists.

Naturally, there are things about this film which one might readily criticize. The elaborate sound-projection system, of which there has been much talk, seems

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to possess many remarkable advantages, not least of which is the ability to "place" sounds. But it also amplifies them too much in certain passages—and that is hard on the ears. The length of the picture—more than two hours—tends to weary the senses, to dull one's receptiveness.

A Frank Experiment — Disney

Sometimes the color is too "pretty," especially in the "Pastoral," and frequently the dramatic action on the screen becomes so absorbing that the music, the primary music, takes an incidental place.

Both those are esthetic details which the majority will casually ignore. Mr. Disney himself said the other night that there are many problems he has yet to lick, that "Fantasia" is a frank experiment. Perhaps so, but it is also the most original and provocative film in some time. If you don't mind having your imagination stimulated by the stuff of Mr. Disney's fanciful dreams, go to see it. It's a transcendent blessing these days.

By OLIN DOWNES

N. Y. TIMES MUSIC CRITIC

This comment upon "Fantasia" is to deal with its musical aspect, inseparable as that is from the "picturization." From one musical point of view, this "Fantasia" is indisputable proof of the amazing and wholly creative things that can be done by the combination of animated design, color and music, and a most forbidding example of what not to do with this magnificent apparatus.

Magnificent Sound Reproduction

The principal merit of the offering appears to me the reproduction of sound, which is of unprecedented effectiveness—this, and the proof of the vitality of great music under any circumstances of defacement in the name of interpretation in popular ways of the art.

Sound is reproduced with a degree of color and effectiveness without a precedent in my experience of either the screen or the radio. Moments in a new theatre, of poor acoustics, when the orchestra was suddenly too loud or suddenly a bit fuzzy, will quickly, one believes, be eradicated. The point is the texture and color of tone conveyed. That "tone-color" of which every musician speaks, and which is particularly the attribute of orchestral music, is here reproduced with a completeness and sumptuousness for which Mr. Crowther may be able to furnish a precedent, but I cannot.

We come now to the pictorial interpretation of the music. There is no question, of course, of the validity of Mr. Disney's purpose, although there are authorities who insist that worth-while music is untranslatable in any other language but its own; that the listener should be left free to find in it his own meaning or images, and not ideas imposed by some one else than the composer; and that no good is accomplished by trying to scramble different arts together.

Questions Studio Men's Interpretations

Deems Taylor, the narrator, remarked that these are the interpretations of music which occurred to the men of the studio. Well, if there had been among them a genius of the calibre that Mr. Disney has shown himself to be in his special metier,

Bill Wise SAYS—
PROJECTIONIST



"I'm the one who gets it in the neck when "Fake" parts get into my projectors . . . so I insist on getting Genuine Simplex Repair Parts"

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Only complete reels, as described below, are available (no short sections or single frequencies). The prices given include shipping charges to all points within the United States; shipping charges to other countries are additional.

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Approximately 500 feet long, consisting of special targets with the aid of which travel-ghost, marginal and radial lens aberrations, definition, picture jump, and film weave may be detected and corrected.

Price $37.50 each.

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Approximately 400 feet long, consisting of recordings of several speaking voices, piano, and orchestra; buzz-track; fixed frequencies for focusing sound optical system; fixed frequencies at constant level, for determining reproducer characteristics, frequency range, flutter, sound-track adjustment, 60- or 96-cycle modulation, etc.

The recorded frequency range of the voice and music extends to 6000 cps.; the constant-amplitude frequencies are in 11 steps from 50 cps. to 6000 cps.

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The National, State and Local Tuberculosis Associations in the United States

then indeed we would have had something.

We could have had from last night a fantasia of musical sequences in which the fanciful and absurd, the witty and romantic, the burlesque and the sentimental were delightfully commingled. What we saw was a conglomeration remindful of Mark Twain's Colonel Sellers at the breakfast table, "planning a railroad which should run through Slouchburg and Doodleville, Belshazzar, Catfish, Babylon, Bloody Run, Hail Columbia and Hark From the Tomb."

Footless was the picturing of the Bach D minor fantasia and fugue in terms of wandering comets and flashes and sploshes of color which supplied no parallel to the eye of Bach's architecture for the ear. The picture became suggestive for the listener only in certain places, where gathering light intensified on the screen as the great organ chords of the composition were built up in their shattering power by the lord of orchestral sonorities, Leopold Stokowski.

Witless, Inapropos Combination

Other things were worse than footless. Why the Beethoven "Pastoral," of course and of necessity cut for the occasion? If Beethoven's idea is too dull, then let it be. But for Heaven's sake!—to inject into this simple and wonderfully beautiful musical evocation of the country-side groups of "Centaurettes," rouging for encounters with many centaurs who looked like a cross between a prize-fighter, a bartender and a horse's buttocks, and then set these to billing and cooing together, the while a red-nosed and bulbous caricature of Bacchus burlesque the show! This, to my mind, is as witless, as utterly inapropos of Beethoven's music as any invention could be—really terrible!

And as for the "Sacre du Printemps": Stravinsky is said to have appeared in the Disney studios, and exclaimed wonderingly, "That is what I must have meant by my music." If so, we say in all candor, our very respected Mr. Stravinsky should have taken off his hat and blushed. The best that the interpreters of this music could devise for the development of the story of the "Sacre" was some flamboyant impressionism and then a set of drawings of dinosaurs fighting, devouring their prey and limping wearily off on a trek to death in the midst of an arctic snowstorm.

There are, we can assure the reader, much better stories than that in Stravinsky's music. The screening had again seconds of effect, as when explosive accents of this most kinetic and explosive music coincided with the sudden explosions of volcano craters, and turbulent noise agreed with the general sensation, as lava rolled down mountains, and glaciers split rocks, etc. But even these successes were few and far between, and the resemblances superficial.

Music's Survival the Wonder

The wonder was the manner in which Bach and Beethoven and Stravinsky, cut and variously fitted to the picture, survived them. The music survived, despite its inadequate representation. And furthermore: a way is opened by this spectacle which will be followed, very possibly by Mr. Disney himself, after a plan more appropriate than last night's, and will certainly open paths for other creative efforts with pictures and music.



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(Signed)

Cecil R. Wood, Jr.

Chief Projectionist
"The Broadway",
New York City

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DECEMBER 1940

VOLUME 15 • NUMBER 12

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 15 DECEMBER 1940 *Number 12*

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Monthly Chat

CURRENT widespread interest in control-track sound reproducing systems bids fair to raise merry hob with sales of sound reproducing equipment during the next few months—or at least until standards are set up in authoritative quarters—according to the content of I. P.'s mailbag over the past several weeks. And this interest is not confined to projectionists, because among our correspondents are many exhibitors, who probably took their cues in this respect from their respective projectionists.

All the fuss started, of course, with the great gobs of publicity attendant upon the first showings of "Fantasia"; but this Disney achievement would not of and in itself have precipitated the worries that now furrow the brows of so many projectionists and exhibitors, not to mention the distraught manufacturers who visualize several lean months ahead. The real cause of the stampede was the follow-up announcement by RCA anent its Fantasound system, which will go into various Warner houses shortly.

Nobody questions RCA's right to clarion the merits of Fantasound; nor should there be any criticism of the speed with which other manufacturers rushed into print with cries of "me, too." The real danger lies in the fact that such well-intentioned, but poorly-timed, publicity about control-track sound systems will scare off many customers who are about ready to replace outmoded sound equipment with modern units.

This situation calls for a bit of plain speaking, in justice to all concerned. First, it would be well to bear in mind that as yet there has been no agreement reached on recording standards, and until this is done there cannot possibly be any general agreement as to the exact form of the reproducing equipment required. Second, any reputable sound equipment now being offered for sale can be adapted so as to render eminently satisfactory reproduction of the improved type of recording, irrespective of what form it takes.

"But," asks Mr. Exhibitor, "if I bought new equipment now, wouldn't it cost me more to alter for control-track reproduction, after the standards are set, than if I should wait and buy equipment specifically designed for the new recording?" The answer to which query is that it would be a Mexican stand-off, six of one and a half dozen of the other, so to speak. The new recording will require additional amplification in any event and, in terms of performance, it matters little, if any, whether currently available equipment is subsequently modified, or an equipment specifically designed for the job is purchased later.

Thus, whether the consideration be that of quality performance or overall cost, Mr. Exhibitor is protected.

. . . UNSOLICITED TESTIMONIAL FROM ONE OF THE BOYS IN THE BOOTH!

November 14th, 1940.

Brenkert Light Projection Co.,
Detroit, Mich.

Gentlemen:

On November 8th, last, a pair of your Brenkert BX-80 projectors were installed in the projection room of the Harris-Warren Theatre, Warren, Ohio.

I wish to congratulate you on the finest projection equipment that I have ever had the pleasure to work with in the past 27 years. Any exhibitor or theatre owner that is considering new projection room equipment would be "wise to Brenkertize" his projection room.

Again congratulations and good luck.

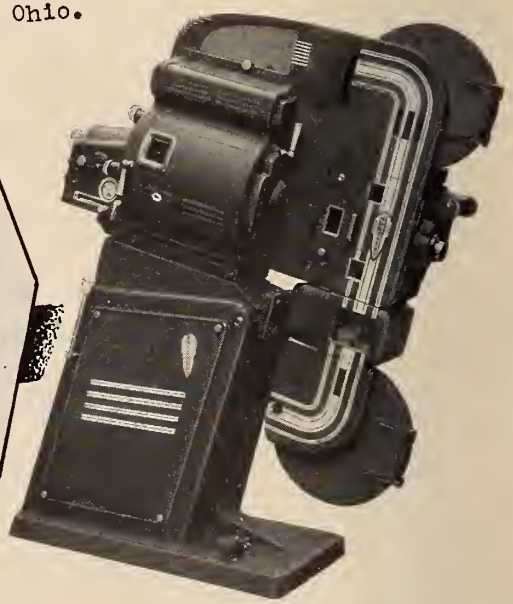
Eugene Klingensmith

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VOLUME XV DECEMBER 1940 NUMBER 12

'Fantasound' Soundheads and Amplifiers

II.

A GENERAL description of the RCA Fantasound system and its operation in reproducing the unusual sound effects of Walt Disney's latest triumph, "Fantasia," was given in the last issue of I.P. It was pointed out that aside from special multi-track soundheads and variable-gain amplifiers, all components of the Fantasound system are standard sound reproducing items now being sold with current theatre sound equipment. Since most projectionists are familiar with the elements of a standard sound system, this article will be devoted to an explanation of the special soundheads and the operation of the variable-gain amplifiers.

Because Disney wanted to produce unusual effects with acoustic perspective, making the sound appear to move about the auditorium and issue from many sources instead of only one as in a standard system, it was necessary to expand the Fantasound system into three complete sound systems, with three separate amplifier channels and three stage speaker setups located on the right, center, and left of the stage, respectively.

To supply each of these three channels with separate sound sources, it was necessary to use three program soundtracks instead of the usual one. Then, to automatically adjust the volume level of each channel to get greater volume range and more realistic reproduction, it was necessary to use a fourth soundtrack, known as the control track.

Obviously, there was not room on a standard picture film for four soundtracks, so a special sound film carrying the three program tracks and the control track was recorded on standard 35 mm. stock. In reproduction, the sound film and the picture film are run simultaneously, the former in a special multi-track soundhead and the latter in a standard picture projector.

By *R. J. KOWALSKI*

PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

The Automatic Control Track

The control track has three separate tones recorded on it, superimposed on one another. The tones used are 250, 630, and 1600 cycles. As will be shown hereinafter, the intensity of each of these tones determines the loudness of the reproduction from one of the three amplifier channels. Each of the soundtracks on this film is twice normal width, so it is possible to record signals on them that are twice as loud as the loudest signal that could be recorded on a standard soundtrack.

The accepted volume range of a standard variable area soundtrack is approximately 35 decibels. This means that if the weakest signal recorded on the soundtrack is made 35 decibels lower in level than the loudest signal that can be recorded within the limits of the soundtrack, the inherent film noise due to graininess, scratches, *etc.*, becomes noticeable in comparison to the weakest signal. By doubling the width of the soundtrack, the loudest signal may be made 6 decibels louder, so the total usable range then becomes 41 decibels with the same signal-to-noise ratio that is found in standard recordings.

Disney, however, has chosen to limit the range that he actually recorded on the film to only 25 decibels, so that the weakest signal recorded on the "Fantasia" soundtracks is a full 16 decibels higher in level than the weakest signals found on standard soundtracks. This means that the signal at all times is many times greater than the film background noise and hence the reproduction is unusually quiet. It was possible to restrict the recorded range in this manner because the control track was available to supply the necessary volume expansion to restore full volume range to the music once again.

The range of control on the variable gain amplifiers is so great that it is possible to expand the 25-decibel volume range recorded on the film to the full 70-decibel volume range of a large symphony orchestra.

The Multi-Track Soundhead

To reproduce signals from four soundtracks simultaneously, RCA engineers had to develop a special multi-track soundhead. This soundhead has its own mounting pedestal and a set of upper and lower magazines. It is driven by a three-phase Selsyn drive motor which keeps it always in exact synchronism with the picture projector which is also driven by a Selsyn drive motor *from the same Selsyn generator.*

Figure 1 shows a close-up view of the

inside of the soundhead. A double, reversible exciter lamp socket is provided carrying one active and one spare exciter lamp. If an exciter lamp should burn out, it is necessary only to remove the socket, reverse it, and re-insert it to put a new lamp in position. A special optical system forms the light from a signal exciter lamp into a uniform scanning beam that is one mil. wide and long enough to scan all four tracks.

A standard rotary stabilizer could not be used because the entire film has to be scanned and the solid sound take-off drum would not allow light to pass through. Hence a special aperture was developed to permit this type of scanning. A magnetically-driven drum located immediately below the aperture drives the film past the scanning point at a very uniform speed. The magnetic drive is identical to the one that has been used on all RCA Film Recorders for many years.

The meter shown in Fig. 1 indicates the strength of the current that is being fed to the magnetizing coils on the magnetic drive. The knob immediately below the meter adjusts a rheostat which controls this magnetizing current.

A pair of rollers ahead of the scanning aperture and another after the magnetically-driven drum maintain film loops which filter out any irregularities which may be imparted to the motion of the film by the feed and hold-back sprockets.

After the scanning light passes through the film at the aperture, it passes on to four photocells mounted in a front photocell compartment. Each photocell is connected to its own photocell transformer which matches the high impedance of the cell to a low-impedance line which couples the soundhead to the amplifier system.

Routing the Three Tones

The complex control signal (combination of three tones) generated in the control track photocell is amplified and built up to a high level by a pre-amplifier, voltage amplifier, and a power amplifier. This high-level signal is then fed to each of the three main channel amplifier racks. A 250-cycle band-pass filter on Rack 1 accepts the 250-cycle portion of the complex control tone and rejects the other two tones. A 630-cycle band-pass filter on Rack 2 and a 1600-cycle band-pass filter on Rack 3 accept 630 and 1600 cycles, respectively, rejecting the undesired components. In this way, the complex control tone is separated into its individual parts and one tone goes to each rack.

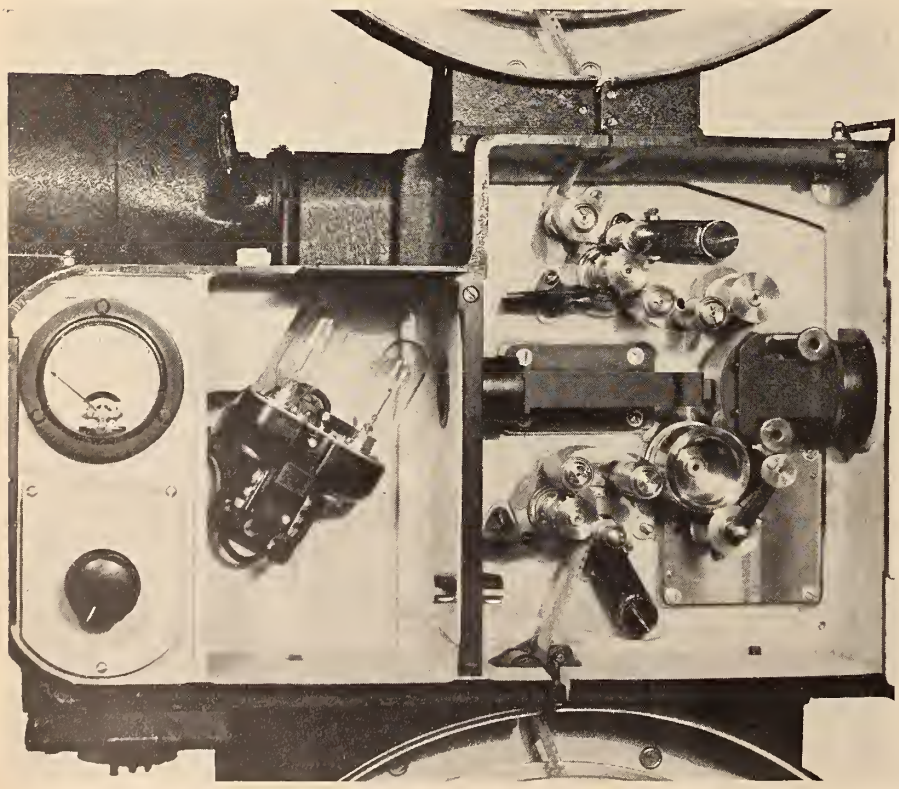
After coming through the band-pass filter each control tone is fed to a tone rectifier which rectifies the A.C. tone producing a D.C. voltage. The value of this D.C. voltage is at all times proportional to the strength of the control tone, becoming higher as the control tone gets stronger.

The variable D.C. voltage is then applied to the grid circuit of the first amplifier stage of the variable gain amplifier as a bias voltage. The first stage of the amplifier consists of a balanced pair of RCA 6K7 tubes in a push-pull circuit. The RCA 6K7 is a remote cut-off, super control pentode tube so constructed that the gain of the tube may be varied over wide limits by changing the bias voltage.

Two ordinary amplifier stages follow this variable gain stage to further ampify the signal before passing it on to the power amplifiers. Controls are available on this amplifier to change the expansion characteristics so that varying degrees of volume changes can be obtained for a given change in control signal. By this arrangement the equipment can be adjusted to give any overall volume range that the size and acoustics of the theatre will permit.

By the proper combination of these two new pieces of sound reproducing equipment with standard Photophone amplifiers, speakers, and power supply units, a very versatile system has been created which now brings unprecedented sound reproduction to theatre audiences. It is expected that the future will bring even more unusual effects and more realistic reproduction.

FIGURE 2. *Close-up of inside of 'Fantasia' soundhead.*



Scophony's 9x12-ft. Tele Image For Movie Theatre Use

Coincidentally with the premiere American showing in N. Y. City of its theatre television before an audience of 150 newspaper and technical men, Scophony, Ltd., announced that a N. Y. banking group had pledged 2½ millions for the promotion of this equipment in the United States. Scophony, a British corporation, has already filed application with the F. C. C. for licenses to establish visual broadcast stations in New York, Chicago and Los Angeles, and plans to lease its units to theatres within present television range of the aforementioned cities for a one-year period.

Rear Projection Utilized

The Scophony demonstration utilized rear projection equipment to present a 9 x 12-foot image of fairly good quality overall, although the illumination level left something to be desired. This shortcoming was attributed to the use of a makeshift movie studio which lacked complete lighting facilities. It was announced that new developments recently concluded in England would increase screen illumination tenfold.

Equipment is of the generally accepted 441-line, 30-frame type. It is claimed that the average projectionist can learn to operate the device in a half hour. The screen is of a type that will permit a theatre to use it for regular film projection, although it is doubtful that such procedure would net good results.

Scophony plans to grant non-exclusive licenses to responsible manufacturers in this country, in addition to establishing a plant of its own, as well as a "pilot plant" for research.

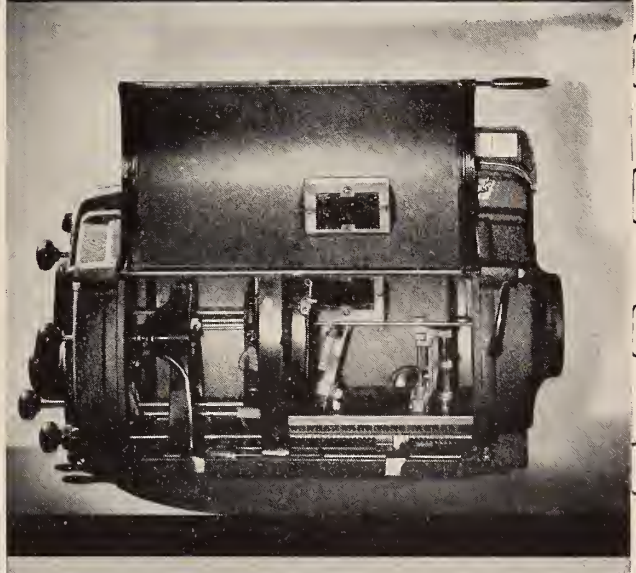
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Projection Optical System Data

By *CHARLES E. SHULTZ*
TECHNICAL DEPT., HEYER-SHULTZ, INC.

IN RECENT years optical science has produced a series of increasingly more efficient projection lenses. In order to take full advantage of these high-aperture lenses in obtaining the additional light and quality it is necessary to take into full consideration the adjustment of the reflector used in conjunction with such lenses. Only by the proper matching of these two component parts of the projection optical system can this be accomplished.

The optical system used in motion picture projection is a coordinated one merging at the aperture. There is imaged on the screen the crater of the positive carbon and this image is interrupted at the aperture by the film, which is also on a focused plane. If the entire aperture assembly plate itself were removed, a focused picture of the crater of the positive carbon would be focused at the screen.

If, then, the aperture of the projector becomes the fulcrum point of the coordinated optical systems, it is of vital importance that a balance be established between the objective system and the reflector system for maximum distribution and efficiency.

To obtain speed, or f equivalent (that is, $\frac{\text{focal length}}{\text{diameter}}$) we divide the equivalent focus (E.F.) of the objective lens by the diameter; or:

$$\frac{\text{E. F. of lens}}{\text{diameter of lens}} = f \text{ equivalent.}$$

For example, let us suppose that an objective lens has an arbitrary E. F. of 5″ and the smallest opening measures 2″ in diameter. Here the f equivalent = $\frac{5''}{2''}$ or f 2.5. Most lenses have the E. F. marked plainly on the barrel and, therefore, this calculation is rather simple.

In a similar manner, we may determine the speed of the reflector as follows: subtract the depth of the reflector from the working distance of the reflector and divide this result by the diameter of the reflector; or, Speed of the Mirror =

$$\frac{\text{Working Distance minus Depth}}{\text{Diameter}}$$

For example, let us consider a reflector with an arbitrary working distance of 27″, and 10″ in diameter with a depth of 2″. The speed of the reflector is:

$$\frac{27\text{-}2}{10} = \frac{25}{10} = 2.5$$

If the speed of the lens has been determined, but the working distance of the mirror to match this speed is unknown, proceed as follows: multiply the diameter of the reflector by the speed desired and add the depth of the mirror to the result. This figure will represent the working distance to match this speed; or:

Diameter × Speed Desired + Depth

Calculating Working Distance

For example, with the aforementioned reflector of arbitrary diameter of 10″ and depth of 2″ in which a lens of f 2.5 is to be matched, the calculation is as follows: multiply the diameter of 10″ by the desired speed of f 2.5 (2.5 × 10″ = 25″) and add the depth of 2″ (25″+2″ = 27″) the working distance.

Overcrowding of the objective lens, *i.e.*, having a mirror set in such a position that its speed is greater than that of the objective lens, creates a loss of efficiency as well as of distribution at the screen. Example: objective lens f 2.5, 10″ mirror 2″ deep set at 22″ resulting in a speed of f 2.0.

Reversing this, or using a lens of greater speed than the reflector, results in loss of efficiency but very good distribution.

Example: a lens of f 2.5 used with a 10″ mirror 2″ deep at 30″ resulting in a mirror speed of f 2.8, in which the mirror would not fill the entire objective lens, would mean that all of the lens is not performing the function required for the speed of f 2.5 and would resemble, in operation, the placing of a "stop" reducing its opening to 1.785″ in diameter rather than 2″ in diameter.

Overcrowding results in minimum depth of focus of the mirror and lens, as well as poor distribution, and is more likely to produce unwanted color than a mirror that does not quite fill the lens. The latter, as previously described, results in greater depth of focus for both lens and mirror, better distribution but less efficiency.

Every installation should be judged according to the speed of the objective lens utilized. The vital importance of carefully matching the speed of the two interlocking optical systems, as described, cannot be stressed too strongly.

As every part of an ellipsoidal curve will throw a complete "spot," the complete image of the crater thrown on the aperture is composed of an infinite number of superimposed "spots," or discs, of light each one progressively smaller as reflected respectively from center to outer parts of an ellipsoid; thus the outer areas form the smallest of these discs and produce the bright center of the screen image.

Data on Spot Formation

If we were to paint the entire surface of an ellipsoidal reflector with black paint, so that no light could be reflected from it, and then were to remove this paint in one very tiny little spot about the size of the head of a pin, we would find that, no matter where this were done on the reflecting surface, a complete image of the crater of the positive carbon would be focused at the aperture—very dimly, of course, as such a small percentage of the reflecting surface would be utilized. By removing another bit of paint on any other part of the same curve, another focused image, or "spot," would be formed superimposing itself over the first and the image would be approximately twice as bright as the first "spot" had been alone.

It also would be noted in this experiment that the nearer the center hole of the reflector this tiny area of the reflecting surface were used, the larger would be the focused image of the crater; the nearer the outer edge of the reflector, the smaller would be the image of the crater; the nearer the outer edge of the reflector, the smaller would be the image of the crater, and this image would be oval rather than circular in shape as when formed from the central area.

Let us start from the central area of the reflector at the center hole and measure to the face of the positive carbon, which figure will be the focus of the mirror. We will then measure from the face of the mirror at the center hole to the aperture of the projector (not the cooling plate) which figure is the working distance of the reflector. By dividing this focus into the working distance we obtain the ratio of magnification for the largest disc of light from the "spot."

By measuring from the outer section of the reflector to the face of the positive carbon, and from the outer section of the reflector to the aperture and dividing this

focus into the working distance, we obtain the ratio of magnification for the smallest disc of light; or

$$\text{magnification ratio} = \frac{\text{working distance}}{\text{focus}}$$

forming the "spot" from any point on the surface of the reflector.

The relative lengths from different points on the surface of the reflector are not alike, although the sums of their working distances and foci are always equal (if the focus and working distance are at the foci of the original ellipse) and they fall at conjugate focus at the same point, but the "spots" formed are of unequal diameter and area.

For example, referring back to our surface covered with paint, let us suppose that we had a little point of reflected light from the center of the reflector which produced a "spot" of a given size at the aperture. In Fig. 1, we would measure from this point on the reflector to the face of the positive carbon, A, which is the focus, and then we would take another measurement from this point to the aperture of the projector, B, which is the working distance.

Dividing this focus into the working distance we would have the ratio, which, when multiplied by the size of the crater of the positive carbon, would give us the size of the "spot" at the aperture from this little point on the surface. Any other point on the surface of an ellipsoidal reflector may be computed in exactly the same way.

Diameter of 'Spots'

The addition of the working distance and focus is always equal on any point of the surface of an ellipsoidal reflector, provided that these points are at the foci of the original ellipse. That is, the focus A in Fig. 1 plus the working distance B would be equal to the focus C plus the working distance D, or A + B = C + D.

To determine the diameter of "spots" formed from any part of an ellipsoidal reflector, we multiply the ratio of magnification taken from that point by the

TABLE A

FOCUS AND RATIO AT VARIOUS WORKING DISTANCES FOR H-S ALL-METAL REFLECTORS

Models 1350-1400

Working Distance	*Focus*	*Ratio*
29	5 15/64″	5.54 to 1
30	5 3/16″	5.78 to 1
31	5 5/32″	6.00 to 1
32	5 1/8″	6.24 to 1
33	5 1/16″	6.52 to 1
34	5 1/32″	6.75 to 1
35	5″	7.00 to 1

Models 1025-1000

22	4″	5.50 to 1
23	3 31/32″	5.79 to 1
24	3 15/16″	6.09 to 1
25	3 7/8″	6.45 to 1
26	3 27/32″	6.77 to 1
27	3 13/16″	7.08 to 1
28	3 25/32″	7.40 to 1

size of the crater formed on the positive carbon.

The diagonal of a standard projector aperture measures 26 mm., therefore, a circle drawn touching the four corners of the aperture will be 26 mm. in diameter, which is the smallest "spot" that will completely cover the aperture.

To find the area of this "spot" we multiply its diameter by itself, and then multiply this result by 0.7854; or its area equals the square of the diameter times 0.7854. Therefore, the area of a "spot" 26 mm. in diameter may be computed as follows: 26 multiplied by itself, or 26 × 26 = 676. This represents the square of the diameter of the "spot." We then multiply 676 by 0.7854 = 530.9304, which is the area in square millimeters of a "spot" 26 mm. in diameter.

For example, we assume that we are using an 8 mm. carbon operating at normal amperage feeding a 14″ reflector with a working distance of 32″ and a focus of 5⅛″ at the central area. By division, as previously shown, we find the ratio of magnification to be 6.24; or

$$\text{ratio of magnification} = \frac{32''}{5\frac{1}{8}''}$$

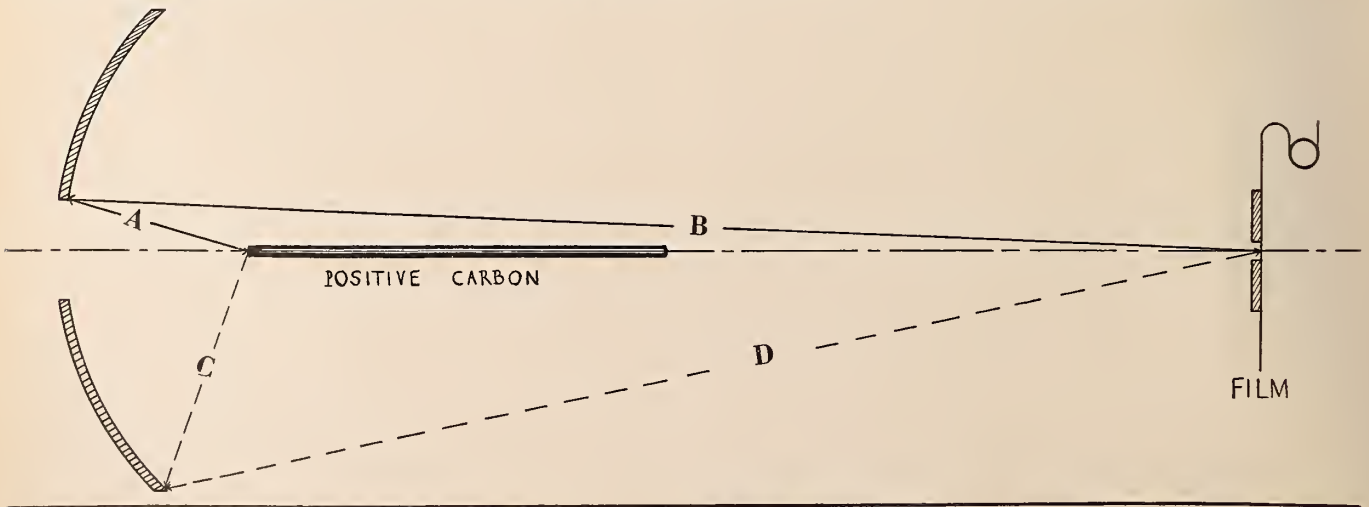
If the size of the carbon is 8 mm., the crater will be approximately 23/32 of the diameter of the carbon, or .71875 (This figure represents the effective positive crater size for an 8 mm. Suprex carbon. For a 7 mm. Suprex positive multiply by .636. For a 6 mm. Suprex positive multiply by .635:) or .71875 × 8 mm. = 5.75 mm. the diameter of the crater. Multiplying the factor for the ratio of magnification by the diameter of the crater of the positive carbon 6.24 × 5.75 = 35.88 mm. is the diameter of the "spot" at the aperture from the center hole position of this reflector and will be the largest "spot" formed from any part of the surface.

These figures are rather general, as the slightest discrepancy in focus measurement may bring about a material difference in the result; great care must be exercised in measuring this focus. However, if measurements of focus are accurate within 1/64 inch, reasonably comprehensive results can be obtained. Much greater tolerances in measuring the working distance are permissible without seriously altering the accuracy of the result.

With an understanding of the conditions governing "spot" size, let us study the effect of moving the same mirror away from the working distance for which it was designed and refocusing a "spot" correctly. Let us place the mirror at an arbitrary distance of 34″; in other words, increase the working distance of this mirror 2″ over the setting we have just explained.

In order to bring the crater of the positive carbon to focus at the aperture it will be necessary for us to shorten the focus to correspond to the added working distance. This change in focus will be very slight, but will create a difference in "spot" magnification. By examining Table A we find that the focus will de-

(*Continued on page* 30)





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GEORGE E. BROWNE, *President*

Records for the Projection Room†

By *J. R. PRATER*
CONGRESS THEATRE, PALOUSE, WASH.

Some portions of the data necessary to good projection room records may be kept to the best advantage on blank forms. Examples are shown of such blanks adapted to (1) an inventory of projection room supplies and spare parts, (2) data on vacuum tubes, (3) exciter lamps, (4) film inspection, and (5) a cue sheet. Noteworthy features are discussed, and suggestions given for adapting these forms to individual projection rooms. Projectionists will find appropriate forms a great aid in compiling records.

THE keeping of detailed records in the theatre projection room is essential to efficiency and to excellence in results produced. Exhibitors and theatre managers who care for efficiency; who wish to achieve the best results at the lowest cost should provide proper blanks for keeping such records, preferably in the form of sheets so perforated that they may be bound in loose-leaf binders and thus retained for future consultation, the value of which later should be evident.

Certain equipment parts are subject to heavy stresses. They wear out and must be replaced with comparative frequency. With a record of the terms of service given by such parts the management is in position to select those brands that the record shows have provided the most efficient service.

Keeping such records involves a bit of extra work for the projectionist, but one who has real interest and pride in his work will not object. Instead he will be more than repaid for the labor involved by the assistance these records will afford him in his work. Keeping such records is a legitimate part of his work.

Appropriate blank forms will be of real assistance in keeping much of the necessary record data. Perforated sheets suitable for binding in a loose-leaf cover may be had at nominal cost at any good stationer's store. The projectionist may rule and head the blanks himself, especially those not used in large quantities. However, since the keeping of such records is definitely to the advantage of the theatre operating cost, the exhibitor should be not only willing but eager to supply printed forms.

† J. Soc. M. P. Eng. (June, 1940).

Supplies and Spare Parts

Figure 1 shows a compact blank for keeping an account of all projection room supplies and spare parts. It is based upon the assumption that a complete check-up of supplies will be made on the first day of each month, which certainly represents good practice. Provision is made for listing the least amount of each item that should be kept on hand for the coming month plus time required to obtain replacements. Comparing this amount with the actual stock at each check-up enables the projectionist to order a full month's supply at one time without danger of omitting necessary items and thus incurring risk of running short.

This form may be made up on sheets large enough for several months, to avoid copying the names of all items every month. Perforated sheets to fit the regular looseleaf binder may be used, or bound pads already ruled with enough columns to serve for a whole year may be had at stationers at nominal cost. In either case, a permanent record would be available enabling computation of the cost of each item at the end of the year. The value of such a record increases the longer it is used.

Vacuum Tube Records

Figure 2 shows a blank for charting vacuum tube data. This sheet will serve for all types of tubes in use. A new blank should be filled out at each complete tube check-up. The time between regular inspections will depend upon the number of hours the theatre operates each day; also somewhat upon the class of performance it must maintain.

Since the normal useful life of most vacuum tubes is about 1000 hours, it is well to check them at least once every 500 hours. Replacements or changes made between regular check-ups may be recorded on the previous blank. Where the same type of tube is used in different stages of amplification, different readings may be obtained with the same tube; hence all spares should be tested in the same socket to give proper readings for comparison. A column is provided for carrying forward the number of hours a tube has already been used in case it will be re-

PROJECTION ROOM SUPPLIES AND SPARES

MINIMUM STOCK TO KEEP ON HAND	ITEM	JAN., 19			FEB., 19			MARCH, 19			APRIL, 19		
		ON HAND JAN.	REPLACEMENTS	AMT. USED	ON HAND FEB.	REPLACEMENTS	AMT. USED	ON HAND MARCH	REPLACEMENTS	AMT. USED	ON HAND APRIL	REPLACEMENTS	AMT. USED

VACUUM TUBES

DATE _____ TESTED BY _____

TYPE	IDENTIFICATION NUMBER	BRAND	DEALER	COST	DEALER'S TEST	NORMAL PLATE CURRENT	PLATE CURRENT WITH GRID SHIFT	PC. DIFFERENCE	DATE INSTALLED	WHICH SOCKET	DATE REMOVED	HOURS USED PREVIOUSLY	HOURS USED THIS TIME	TOTAL HRS. USED	REASON REMOVED

FIGURE 1 *(Upper). Record chart for various projection room supplies*
FIGURE 2 *(Lower). Chart for checking performance of vacuum tubes*

matched and returned to active service.

In addition to providing data necessary to proper choice of tubes, including emergency replacements, this chart enables the projectionist to determine what brand of tubes serves his needs best. While the price of tubes is now so reasonable that this item alone is relatively small, it is definitely an advantage to use tubes that may be depended upon to give satisfactory operation for the longest possible time. Otherwise more frequent check-ups are necessary and faults more likely to develop between them.

A similar and simpler blank shown in Fig. 3 serves for keeping a check on exciter lamps. Like vacuum tubes, the lamps themselves are inexpensive, but a burn-out during a performance must be carefully guarded against. At the same time, there is nothing to be gained by discarding them too soon when it is so easy to keep a record that will show when they have completed their expected life.

Figure 4 shows a blank especially adapted to projection room film inspection. Such a report turned in to the theatre manager is proof of the condition in which prints are received. A copy of such report mailed to the exchange before the show opens, or as soon thereafter as possible, is excellent insurance against unjust claims for damage.

Film Inspection Data

The blank provides for separate consideration of starting leader, soundtrack, sprocket-holes, splices, and cue marks, in addition to the general condition of the film as a whole. The most common faults met with are listed in the headings thus enabling the projectionist to make a reasonably complete record merely by indicating whether the fault exists; or, if present, the amount thereof; and to do this with a minimum of exertion.

The section devoted to cue marks has a psychological value worthy of mention. After reporting the existence of punch holes, scratch marks, grease pencil smears, click patches, *etc.*, month after month, the projectionist who has pride in his work will not feel inclined to inflict additional damage by making change-over marks of his own.

A cue sheet similar to Fig. 5 may be used, instead of making cue marks on the film. Threading marks, arc cues, and curtain cues are seldom the same in various theatres. After several projectionists put their own marks on the film, each in a different place, picking out the one you want is quite a guessing game. And, after all, there is little satisfaction in putting on a smooth performance if the cues themselves damage the show.

It is hoped that projectionists will give blank forms similar to these a fair trial. It may be necessary to use a few hand-made blanks, and to work out any changes needed to fit them to individual needs before asking for a supply of printed forms.

EXCITER LAMPS

LAMP NUMBER	BRAND	DEALER	COST	DATE PUT IN ACTUAL USE	WHICH PROJECTOR	DATE DISCARDED	HOURS USED	REASON DISCARDED

FILM INSPECTION REPORT

THEATRE _____ CITY _____ STATE _____ DATE _____ INSPECTED BY _____

TITLE	EXCHANGE	RUNNING TIME	RECEIVED FROM	STARTING LEADER: SPLICES	STARTING LEADER: MISFRAMES	STARTING LEADER: FOOTAGE MISSING	STARTING LEADER: SPROCKET HOLES TORN	SOUND TRACK: SCRATCHES	SOUND TRACK: SPROCKET MARKS	SPROCKET HOLES: STRAINED	SPROCKET HOLES: STRIPPED	SPLICES: TOTAL NO. IN PICTURE	SPLICES: UNSAFE	SPLICES: MISFRAMES	GENERAL CONDITION: OILY	GENERAL CONDITION: DIRTY	GENERAL CONDITION: SCRATCHES	GENERAL CONDITION: EDGE BREAKS	CUE MARKS: PUNCH HOLES	CUE MARKS: SCRATCH MARKS	CUE MARKS: GREASE PENCIL	CUE MARKS: CLICK PATCHES

CUE SHEET

SUBJECT	REEL NUMBER	RUNNING TIME	THREAD ON	VOLUME	ARC CUE	CURTAIN CUE	MOTOR START

FIGURE 3 *(Top). Cost and performance chart for exciter lamps*
FIGURE 4 *(Center). Film inspection report chart.*
FIGURE 5 *(Bottom). Performance cue sheet*

RECORD 190-MILE ALL WIRE TELE CIRCUIT BY BELL

The longest-all-wire circuit of television images was shown over the week-end by Bell Telephone Laboratories in connection with the recent convention of the Institute of Radio Engineers. Images were projected in New York, picked up and sent by coaxial cable to Philadelphia and then back to New York, a distance of 190 miles.

Images transmitted in New York and sent direct to the hotel by telephone circuits, a distance of approximately three miles, were also shown. Observers noted practically no differences which would be discernible to the layman in the "local" and "long-distance" pictures.

441-Line, 8 x 10 Inches Images

Images were of the 441-line, 30 frames interlaced variety and consisted of films, including A. T. & T. commercial pictures and old tennis shots. They were approximately 8 by 10 inches, being shown on a 12-inch tube.

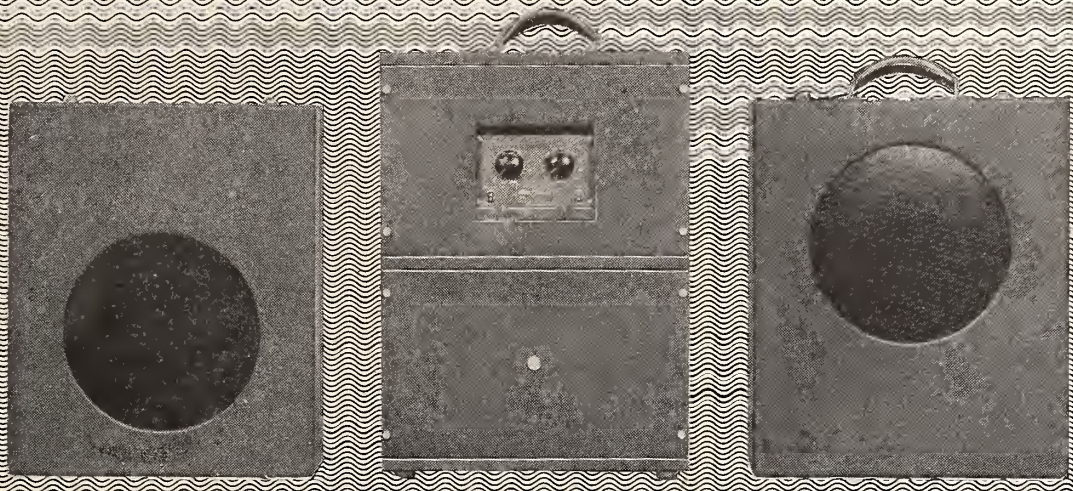
Two cables in a sheath were joined at Philadelphia, it was explained, to form a loop circuit back to New York, with amplifiers located at five-mile intervals. Developments are part of the Bell system's testing plan, it was said, to develop a method of transmitting images by wire similar to the system used in broadcasting.

RCA's N.Y.C. TELEVISION THEATRE

RCA expects to complete shortly the installation of equipment in its first television theatre, The New Yorker, on 8th Ave. in N. Y. City. No date has yet been set for the inaugural performance, which will probably be preceded by several press showings. The latest RCA television equipment is said to offer greatly enlarged images without any sacrifice of detail, which problem has offered the greatest engineering difficulties to date.

Looking at the sound picture  *from the projectionist's port-hole*

RCA Emergency Theatre Sound Equipment is YOUR INSURANCE AGAINST SOUND OUTAGE



This completely portable equipment will substitute for...

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The Cyclex Projection Arc Control Unit

By *C. S. ASHCRAFT*
C. S. ASHCRAFT MANUFACTURING CORP.

THE control units used in the Ashcraft Cyclex projection system perform several functions simultaneously, as follows:

1. Change the voltage of the current delivered by the frequency changer to the proper value for use in the arc.

2. Allow for 16 various arc current adjustments.

3. Change the three-phase current to two-phase, so that one phase may be used in each projection lamp.

4. Provide a magnetic valve between the primary and secondary coils, that is, between the coil which is connected to the frequency changer (primary) and the coil which is connected to the arc (secondary). This magnetic valve operates in conjunction with the arc control driving motor to provide an absolutely accurate control of the arc length.

As is shown in Fig. 1, transformers (control units) are composed of a laminated silicon steel core having a center leg upon which are mounted the primary coil, which is connected to the slip rings of the frequency changer, and the secondary coil which is connected directly to the arc. The current from the frequency changer, flowing in the primary coil, sets up a magnetic field in the steel of the core.

The winding of the secondary coil, mounted upon the same central section, is cut 192 times per second by this magnetic field, consequently a 96-cycle current is induced in the secondary coil. As there are less turns on the secondary coil than on the primary, a lower voltage will be furnished the arc than is produced by the secondary winding of the frequency changer.

Two separate transformers are used in Cyclex, one connected to each arc. The secondary coils of both transformers are identical, but the primary coils are entirely different.

The main transformer, Fig. 2, has a central tap G which is connected to the beginning of the primary winding of the teaser transformer, G1; also, the main transformer has taps equally spaced, on each end of the winding, from the center tap. The teaser transformer has taps on one end only. It is apparent that the arc connected to the main transformer may be operated even if the connection G-G1 is broken; while the teaser transformer is totally dependent upon the main to complete its circuit to the frequency changer.

The taps T1 to T4, K1 to K4, and F1 to F4, inclusive, are for various line voltages. For instance, if the line voltage supplied to the primary of the frequency changer is 240 volts, T1, K1 and F1 would be used; while for a lower line voltage, such as 210, T4, K4 and F4 would be connected to the frequency changer collector rings. These end taps may, however, be used for finer arc current adjustments; for instance, if for a 220-volt circuit T3, K3 and F3 should be used and the arc current found to be too low, then the connections T4, K4 and F4 may be used, which will induce a higher voltage in the secondary coils connected to the arc.

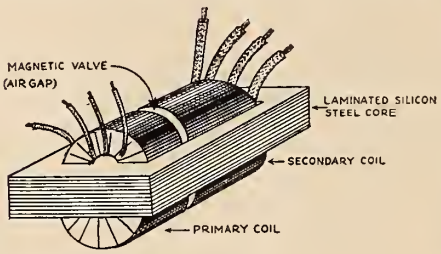


FIGURE 1
Core and coils of transformer

That which really takes place in the Cyclex control unit transformers is that the three-phase current from the frequency changer is fed into the primary windings of the two transformers. In the transformers themselves this three-phase current is changed, by induction, to two-phase current each phase of which is fed to its individual arc. In this way, when both arcs are operating simultaneously, a perfectly balanced electrical circuit is established in the frequency changer which entirely eliminates the possibility of light value change during the change-over periods, when a load change occurs in the power unit.

Transformer Reactance

A certain amount of reactance is very desriable in the equipment used to supply an alternating current arc. Simply stated, reactance as used in the production of the Cyclex arc is electrical and magnetic spring, or elastic, as is evidenced by the difference between the open circuit (no load) voltage of the transformers, before lighting the arc, and the full load, or operating, arc voltage. In Cyclex practice the open circuit voltage approximates 35, while the arc in operation has a normal voltage of about 21.

If this reactance were not present, then the no-load voltage would be nearly the same as the normal arc voltage, and correct arc operation would be quite impossible. Reactance has the following effects upon the arc:

1. Allows a latitude to the arc length.

2. Greatly improves the light waveform.

3. Allows the striking of the second

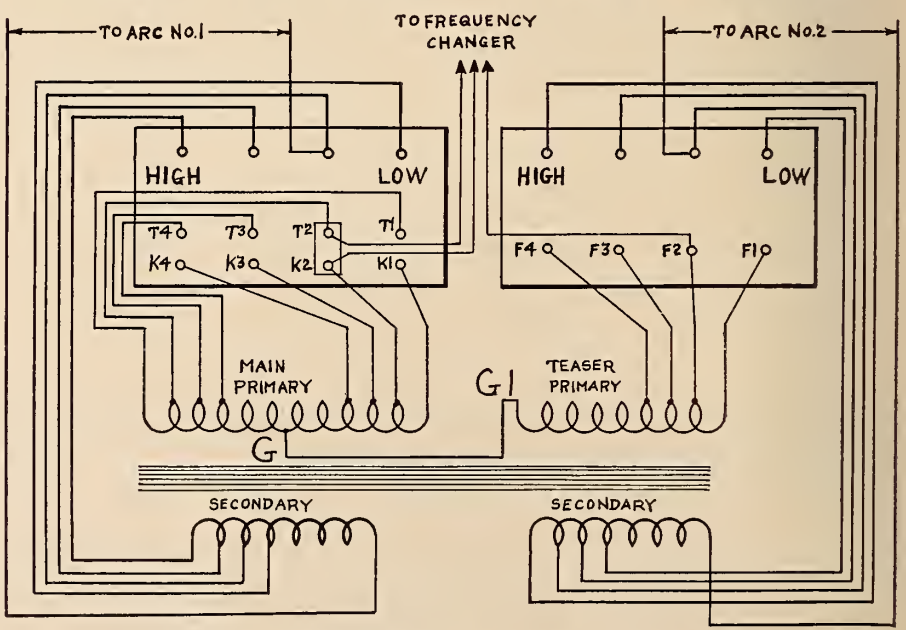


FIGURE 2. ***Interconnections of Cyclex control unit***

arc without visible change in the light projected by the operating arc.

4. Creates an automatic magnetic valve which coordinates the speed of the arc control driving motor to the arc length by amplifying any arc voltage change.

If, instead of using two separate coils placed end to end on the iron transformer core, the secondary winding had been wound over the primary, forming one coil only, the reactance would be negligible. In this case great difficulty in maintaining or controlling the arc would be experienced.

However, the Cyclex transformer is so designed that the coils are not only placed end to end, but to provide for just the right amount of arc resiliency a small space is allowed between the primary and secondary coils. The total reactance is dependent upon the spacing of the two coils.

Referring back to the advantages of reactance in the Cyclex circuit: without the elasticity to the electrical and magnetic circuit, and with an open circuit voltage no greater than the arc voltage, it is obvious that any attempt to increase the arc length over the normal output voltage of a low-reactance transformer could only result in breaking the arc circuit and extinguishing the arc. Also, it would be difficult, if not impossible, to design an arc control for regulation of such a critical arc.

By the design of a fairly high reactance transformer with a high open circuit voltage, the normal Cyclex arc of 5/32″ in length may be opened to a distance of ½″ or 9/16″ without extinguishing. As the arc length is increased there is, of course, a proportional increase in arc voltage, there being a reserve voltage to accommodate such an increase.

Hereinafter it will be explained how this proportional increase in arc voltage to arc length is applied in coordination with the magnetic valve, which is created by properly spacing the primary and secondary coils, to accurately and automatically adjust the speed of the carbon

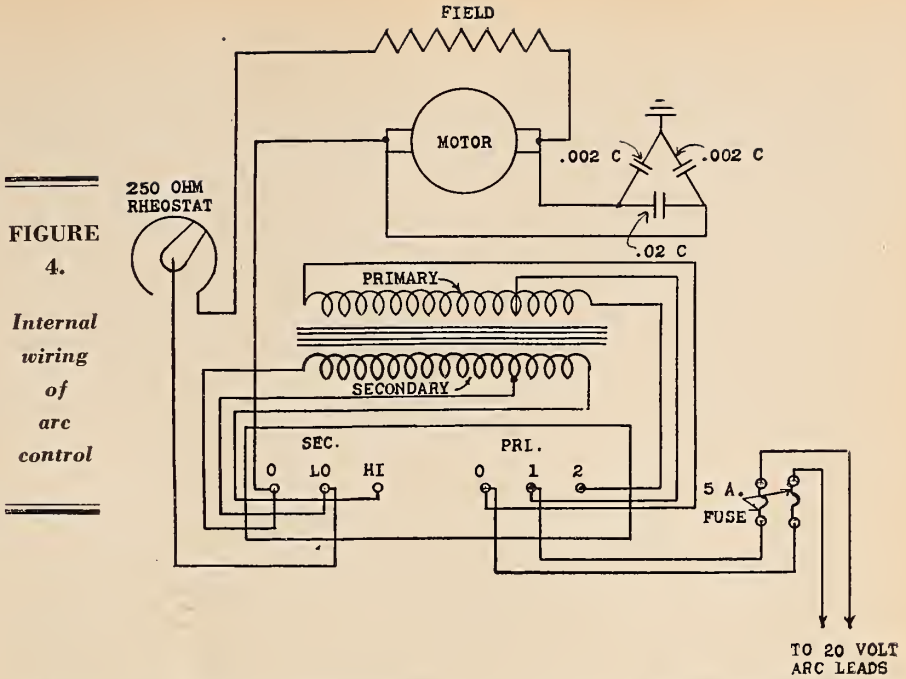


FIGURE 4. *Internal wiring of arc control*

feed motor to exactly compensate for the consumption of the carbons so that a definite and uniform arc gap is constantly maintained.

Unquestionably an arc lamp can be no better than its arc control. This unit is responsible for maintaining a uniform quantity and quality of light upon the screen. Due to the critical nature of any low-voltage arc, it is more difficult to control its light output. The perfect control of low voltage arcs is not practical when either voltage or current control means are attempted separately. Perfect control demands co-ordination between these two factors, preferably a method whereby the current regulates the voltage and the voltage controls the arc-feeding mechanism.

Such a system is used in the Cyclex arc. Other methods where either the voltage or the current is depended upon individually have not proven satisfactory. A fully co-ordinated system of both current and voltage, however, does provide means for extremely accurate arc length control. It must be remembered that an arc control which depends upon a set or predetermined line voltage, either A.C. or D.C., cannot be considered dependable.

The majority of theatres are fed from mains which have a considerable and frequent change in voltage. A satisfactory arc control must be able to automatically adjust itself to these inevitable fluctuations, otherwise the projectionist must continually watch his arc lest it freeze or extinguish.

As explained previously, the arc current flowing in the secondary coil sets up a countermagneto-motive force which opposes the flux generated by the primary coil. This opposing force, at a predetermined current setting, forces the primary flux from its normal path, thus holding the arc voltage at a fairly constant level.

This level, however, is not sufficiently uniform to depend upon for faultless arc control. In conjunction with this stabilizing action of the control unit, Cyclex utilizes an amplifying means consisting of a step-up transformer whereby a slight change in arc voltage is multiplied many times before it is applied to the arc-regulating motor.

Method of Operation

The motor itself must have definite characteristics so that these amplified changes in arc voltage may be utilized to the best advantage. For this reason a motor has been designed in which a slight change in applied voltage will produce a great change in motor speed.

In the Cyclex arc, this control is so accurate that if the carbons are separated 1/16th of an inch, the motor speed is increased immediately and the carbons are fed rapidly toward each other until the previous and normal arc gap is again

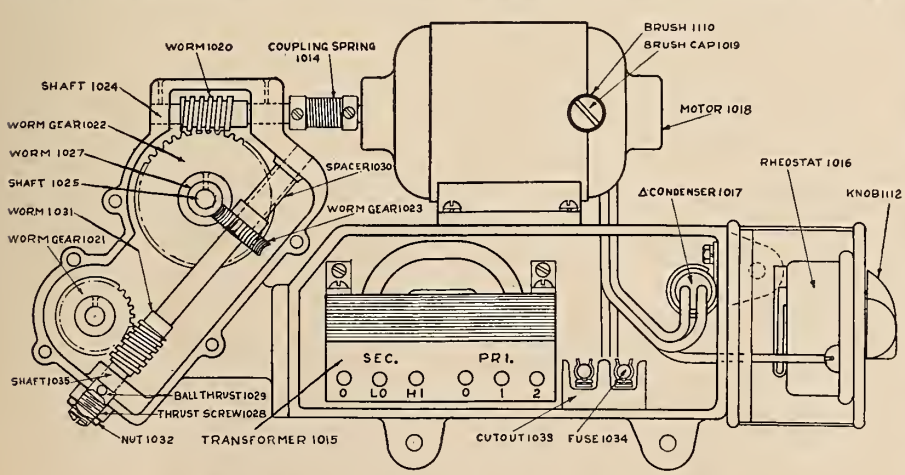


FIGURE 3. *Schematic of arc control unit*

established, whereupon the motor resumes its normal speed, maintaining the arc in that position. Likewise, a shortening of the arc by hand will instantly reduce the motor speed until the arc lengthens to normal due to consumption of the carbons, whereupon the motor speed will be increased, again feeding the carbons at the normal and predetermined rate.

Such a motor must be of the low friction type, therefore full ball bearing. It must operate at a fairly high speed to adapt itself instantaneously to voltage changes. It also must be so designed that the brush life be very long, therefore have sparkless commutation, which fact will insure thousands of hours of continuous operation without appreciable brush or commutator wear or commutator cleaning.

In order to best adapt this fraction free motor to the drive of the mechanism, the Cyclex control employs an extremely high speed reduction gear between the motor and drive shafting (about 60,000 to 1) that is, the motor must revolve 60,000 times before the drive shaft will make one revolution; thus the load upon the motor is practically zero, allowing the friction-free motor to float upon the line, its only duty being to change its speed in accordance with the requirements of the arc.

Current and Arc Control

The Cyclex control units consist of a closed laminated iron core, upon which are mounted two coils. One of these coils is the primary which is connected to the output collector rings of the power unit. The second coil is the secondary which is connected to the arc and motor control. This coil supplies the current for operating the arc.

Referring to Fig. 5, the function of the primary coil is to set up a strong, magnetic flux (lines of force) the instantaneous direction of which is shown by dotted lines A through both legs of the iron core. This flux, passing through the turns of wire of the secondary coil, induces an electric current in the secondary coil for operation of the arc. This current flowing in the secondary coil also creates a magnetic flux, the instantaneous direction of which is shown by dotted line B, and is opposite to that of flux A—that is, the flux created by the arc current in the secondary is forced against and retards that of flux A. The greater the current in the secondary coil, the greater the force of flux B.

Since the flux created by the current in the primary coil induces a voltage in the secondary coil, and the current in the secondary opposes the primary flux, it is obvious that, at a predetermined current, the secondary flux will become sufficiently strong to force a portion of the primary flux from its original path through the secondary coil, thereby limiting the amount of current and voltage created in that coil and thereby limiting the amount of current flowing in the arc.

By spacing the primary and secondary coils a short distance apart a gap or valve is created, through which the primary flux, which is forced from its normal path, will flow, thereby limiting the amount of current and voltage created in the secondary circuit.

Example: It is desired to operate the arc at 60 amperes and 19-21 volts. The proper taps on the control units are selected to give this current with the proper arc gap. The motor control rheostat is set at the position to properly regulate the motor speed so as to feed the carbons properly. Should the arc tend to feed too fast and the arc gap decrease, naturally there will be an increase in current flowing in the arc and secondary coil.

This increase in current will increase flux B, which will force some of flux A through the valve and reduce the voltage to the arc control motor. The motor speed will be reduced until the arc is of the correct length, at which time less flux will flow through the valve and resume its path through coil B.

The Cyclex control unit is so designed that under all conditions there is a certain amount of flux passing through the valve. For this reason, should the arc tend to increase in length, the strength of the opposing flux B will be reduced, thereby allowing more of flux C, which normally passes through the valve, to follow the course of the current and voltage creating flux A.

As this additional flux passes through the secondary coil, more voltage will be impressed on the feed motor, which increases in speed, thus automatically shortening the arc length to the predetermined point at which point flux C will then resume its path through the valve and the motor speed be normalized.

From the foregoing it will be seen that the magnetic valve acts as a frictionless and self-adjusting voltage and current relay which cannot change in its characteristics and can be depended upon to function properly under all conditions.

To adjust the motor speed to various arc currents, a rheostat is placed in series with the field and armature which provides a speed range adequate for a wide range of arc current (Fig. 4). To take care of abnormally high or low arc currents, extra taps are provided on the panel of the amplifying transformer to which the motor or line leads may be connected with a minimum of effort.

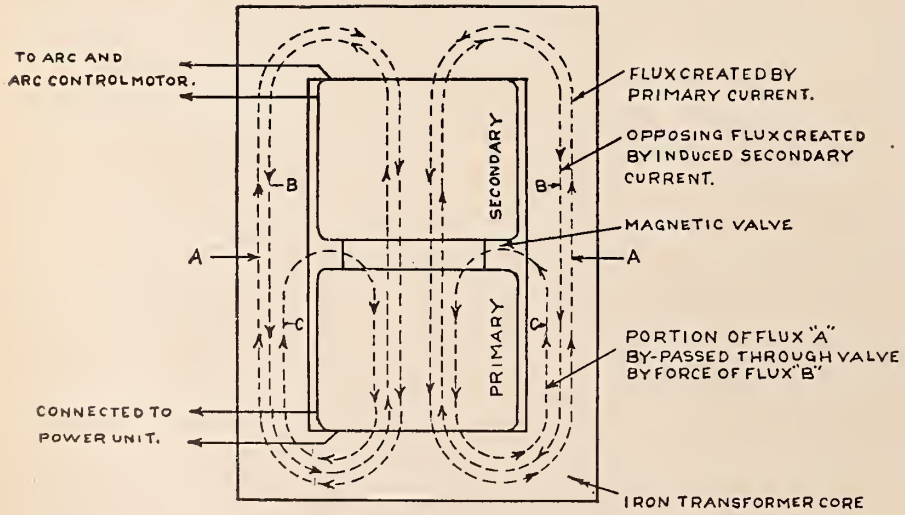


FIGURE 5. *Showing arc control unit magnetic valve*

'Rebecca' Tops Film Daily's Poll of Ten Best Films

"Rebecca" emerges from *The Film Daily's* 19th annual "Ten Best Pictures" poll as 1940's No. 1 feature release. 391 out of the 546 professional film critics and reviewers who cast ballots in the coast-to-coast contest, a landmark of the film industry, nominated the Selznick picture, and it finished with a 24-vote lead.

Placing second in the race for critical laurels was the 20th Century-Fox's "The Grapes of Wrath," with 367 votes. The two pictures ran neck and neck virtually throughout the month-long poll, which officially closed at midnight Dec. 31, thus including only pictures generally released between the dates of Nov. 1, 1939, and Oct. 31, 1940. Under the rules, such pictures as "Gone With the Wind," "The Great Dictator," "North West Mounted Police," "The Long Voyage Home" and "Fantasia" were ineligible.

The other eight outstanding 1940 productions were designated in this order:

Picture	*Votes*
Ninotchka	269
Foreign Correspondent	247
All This, and Heaven Too	230
Abe Lincoln in Illinois	221
Boom Town	215
Northwest Passage	198
Our Town	198
The Mortal Storm	172

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

WHEN the TA-4035 power unit is used to supply a 41 or a 46 type amplifier with filament current, a frequent source of trouble is the burning out of resistor R-13, a bleeder resistor of 5.5 ohms. This resistor is mounted in back of a panel and difficult to replace in a hurry, even if one be available. When the resistor opens up, about 22 volts are placed across the filaments of the 264-A tubes, which burn out very shortly.

A quick emergency repair can be made by installing a resistor or rheostat of about 150 ohms, 25 watts in series with the filament supply to the 41 or the 46 amplifier. This can be installed at the power supply unit or at the amplifier.

In a particular case of trouble, I used a 225-ohm, 50-watt ohmite rheostat normally used in the speed control circuit of one type of arc lamp. No adjustments to any other part of the circuit are necessary.—S. B. EPSTEIN, RCA, *San Francisco.*

• • •

Recently received an emergency call from the Venus Theatre, Shreveport, La. Upon making a changeover found one machine dead, and they were operating on just one position. Arrived before the first twenty-minute reel had been run and checked several points from fader to soundhead before reel ran out. When projectionist was threading up good machine for the second time, found trouble in poorly-soldered connection of signal lead.

Due to thoughtfulness of Projectionist Earl Laird, it was possible to correct trouble without another delay, as he had plugged in the soldering iron as soon as he reported trouble to the manager. Connection resoldered and show continued. This is an excellent example of cooperation between projectionist and sound service engineer.—R. H. STIMPERT, RCA, *Dallas.*

• • •

The new "Listerine" throat light, which may be obtained at any drug store for a small sum, is very handy for exploring the interior of soundheads, projectors, and amplifiers, since it employs a Lucite tube which bends the light around a corner.—B. A. SUSAN, RCA, *Dallas.*

Take-ups on Simplex projectors not infrequently occasion trouble or adjustment. A few simple hints in reference to operation and adjustments may be of help:

The belt should be tight or taut at all times; slippage should be at the clutch disc, not at the belt. If the belt hooks pull out when this condition is maintained, very likely a poor quality of belting is being used or the belting has become rotten.

Take-up discs should be made of a soft leather from a shoemaker, or felt. These should be about two inches oversize so that holes in them may be punched to coincide with the pins in the disc assembly. This places slippage on one side of the clutch disc only. Your car clutch, also industrial clutches, have the facing secured to one plate, as do take-ups on 1A bases, which give little trouble.

If 1½″ or 2″ pulleys are still used, they should be replaced with 4″ pulleys, as the smaller pulleys will not give proper results. The felt clutch discs operate smoother when oiled, which, due to oil leakage on the take-up assembly, is an advantage over the leather.—G. E. HILD, RCA, *New York City.*

• • •

A stripped fibre gear on a W.E. Universal Base 707-type drive was traced to a very unusual cause. Possibly this same "hidden" cause is responsible for other stripped gears—a loose flywheel on the drive motor.

When a flywheel is fastened securely to the motor shaft, its mass will offer considerable inertia to the pickup torque and cause the motor to start slowly. However, if the flywheel is not fastened tightly, it is liable to slip on the shaft when the power is first applied and the motor and machine will start with a jerk due to the lack of flywheel inertia.

There is no doubt that it was this jerk which strained and stripped the fibre gear in question.—E. R. HOLCOMB, Altec, *Deadwood, So. Dakota.*

• • •

The new RCA MI-9050 soundheads with the hinged gear cover makes it much easier to get to the rear of the soundhead for cleaning off surplus oil. However, if the projectors are on a steep angle, the cover has to be held open, and the cleaning done with one hand. To overcome this, open the door and lift up on it. The door will lift off its hinges, and both hands can be used for cleaning and checking.—W. W. GILREATH, RCA, *Dallas.*

• • •

An unused switch has caused more than one sound outage. Every switch, including the 110-120 volt switches inside amplifier, should be thrown at least several times per week. Unused switch contacts oxidize. Switches should be thrown several times before main power switch is thrown on; then check for noise with high gain before show opens.—R. R. HECHT, RCA, *Chicago.*

• • •

I received an emergency call reporting "quiver in sound." On arrival at the theatre I found they were playing *Trailing Double Trouble.* I had to do the same.—STEVE WELSH, Altec, *Chicago.*

• • •

Report from Canada: Noise pickup was being experienced in the sound system of a recent installation. The noise was not confined to the arc lamp relays but the motor switches and electric rewind caused clicks as well. The projectionist cleared the latter two instances by grounding the interference points separately. The arc control noise was cleared by placing a 0.1 mfd., 400-volt condenser across the relay contacts. —H. MONTAGNES, D.S.E.L., Canada, *via* ALTEC.

• • •

It is not generally realized what a beating a sound system takes when operated from a badly fluctuating line voltage. Recently I answered a call from a theatre which had distributed 350 passes and a very appreciable amount of money in refunds. The trouble was a burnt-out power transformer in the main amplifier caused by excessive surges in the line voltage.

During the preceding few days the line voltage at this theatre had jumped to as high as 140 volts. Undoubtedly these excessive voltages had injured the windings of the transformer. A manually-operated voltage regulator was in service but it was powerless to cope with

the rapid surges that were being experienced.

Theatres having poor line voltage regulation should complain constantly to their power companies. Not only do high voltage surges invite the hazard of total breakdown of some part of the equipment but they constantly "nibble" at the life of vacuum tubes as well as other electrical parts that are subject to slow deterioration.—J. W. GILROY, Altec, *San Jose, Calif.*

• • •

Who hasn't cursed those "split type" locknuts that are used on many equipments to lock the adjustment of film guide rollers, pressure pads and take-up tension? Here is a stunt which will actually make such locknuts lock.

Take a thin hacksaw and increase the depth of the "split" cut. Don't go too far or you are liable to split the nut entirely in two. Increasing the depth the proper amount will make the nut more flexible and provide more leverage so that it can be easily tightened by the set screw and the threads really locked. —Altec, *New York.*

• • •

Call reported poor sound and requested an engineer to investigate. By the time the engineer arrived at the theatre, the manager had already located the trouble. The show was being reproduced through the P.A. horns instead of the stage horns!—G. S. ANTHONY, Altec, *Providence, R. I.*

• • •

Setting for a mystery: Theatre reported "Twice this evening there were two short thumpy sounds followed by a high-pitched crackle effect which lasted only a few seconds each time and then disappeared."

The trouble was found to be a poor internal contact in a switch of the main amplifier. The strange sounds could be produced only by pulling on the terminal out of the switch, and each time this was done the plate circuit was interrupted. The spring effect and the varying resistance of the contact did the rest.—CHARLIE THONSEN, Altec, *Pittsburgh, Pa.*

• • •

Oil has been termed "liquid gold," which description, however, applies only when oil is properly used. A recent emergency call reported the sound was O. K. but the "volume control was burning up," and asked that an inspector come at once.

The trouble was found to be due to excessive oil from the projector head dripping onto the exciter lamp rheostat. The rheostat was hot and whenever a drop of oil struck it a cloud of smoke resulted. It is the toughness of a film of oil which makes possible and keeps going the wheels of our mechanical age. However, only a *film* of oil is needed on most bearing surfaces, not a deluge.

Many common sound system troubles are entirely due to too much oil—oil-soaked lens assemblies which cause poor quality and loss of gain, oil-soaked wiring which causes noise and hum, dirty contacts, dirty photo-electric cells, deterioration of rubber cushions, and what not.

On page 35 of the Nov. issue of I.P.[1] is recorded in lucid phrases what happens when too much grease and oil is applied to rotating machinery such as motors and motor generators.—BILL GOODWIN, Altec, *Philadelphia.*

• • •

One of my theatres reported that the emergency arc generator repeatedly blew fuses when first started up and that operation was impossible. The fuse trouble, of course, was caused by excessive starting current and the problem was to get through this starting period safely until the current dropped to normal and the fuses would hold.

The projectionist got "over the hill" by impressing into service an old ballast rheostat which he connected in the circuit for temporary use as a starting resistance. During the starting period this substitute starting resistance cut down the starting current to below the operating value of the fuses, and as soon as the converter came up to speed the resistance was cut out of the circuit.—C. S. LUNDY, Altec, *Boston.*

[1] *"Excessive Greasing a Prime M. G. Maintenance Problem."*

Simplex System Can Handle New Recordings

SIMPLEX 4-Star sound systems may be easily adapted to accommodate whatever form of dual-track stereophonic and push-pull recording is standardized upon by the Academy of M. P. Arts & Sciences, now working on the problem, according to advices from Herbert Griffin, vice-president of International Projector Corp.

"You can state most emphatically that the Simplex 4-Star system will handle any type of modern recording that may be agreed upon by the industry," said Mr. Griffin. "There seems to exist some confusion in the minds of many in the industry that the introduction of a new recording method will mean that practically all current sound reproducing systems will be rendered obsolete. Of course, there are some reproducers that will have to be discarded when the new recording makes its bow, but this emphatically does not apply to the Simplex 4-Star system.

"At the time the Simplex system was designed there was no definite indication that any major change might come about immediately, but it was obvious that the technique of sound recording and reproduction could not possibly remain static. Our engineers, therefore, were faced with the problem of canvassing every possibility of what might happen in the years ahead and to design equipment which could readily accommodate any of the several improvements which might be made in the years to come. This foresight will soon begin to pay dividends, and exhibitors will be put to only minimum expense when adopting these new developments."

International Projector Corp. maintains close touch with the situation through its permanent engineering representative in Hollywood.

Improper P. E. Cell Hook-Up a Tough Problem

ONE of my theatres reported "sound lost" on one machine. I found the trouble to be due to the photo-electric cell on that machine being connected in reverse, *i.e.*, the connecting wires were reversed so that the +90 volts was connected to the cathode of the photo-electric cell, while the anode of the cell was connected to ground.

Every once in a while during the rush of replacement a photo-electric cell is connected up in reverse. Usually, the cell will still operate, although the output of that machine will be very low compared with the other machine with a properly connected cell. Considerable evidence at hand suggests that the explanation for this phenomenon of the photo-electric cell is as follows:

Both elements of a photo-electric cell can be made to emit electrons, operate the cell and pick up sound, regardless of how it is connected. Normally, positive potential from an outside source is connected to the anode (wire) element; whereas the cathode (plate) element of the cell is connected to ground. When light strikes the cathode, it dislodges electrons from the cathode surface which are attracted to the anode by the positive potential of the latter, and a current flows.

On the other hand, if the external polarizing voltage is connected incorrectly so that the cathode of the cell is made positive and the anode is made negative, a current also will flow. The light striking the anode element of the cell dislodges electrons from the anode which are then attracted by the cathode's positive potential. However, since the anode is a very inefficient emitter of electrons, relative to the cathode, a comparatively small current will flow.

In one case which was actually measured, the ratio of the currents which flowed when the cell was properly connected and when the cell was improperly connected was approximately 30 to 1. Roughly, this represented a 30 db difference in output level.

A minute current will flow even if the photo-electric cell is connected up without any polarizing voltage at all. This current is so small, however, as to be of no value in sound-film reproducing machines.—R. P. EGRY, Altec, *Pittsburgh, Pa.*

National Power Survey Results†

A REPORT OF THE THEATRE ENGINEERING COMMITTEE OF THE S. M. P. E.

An account of the work of the several sub-committees of the Theatre Engineering Committee during the past year. The report of the Sub-Committee on Projection Practice embodies a comprehensive power survey in theatres throughout the country, and interim reports of the Working Committees on Tools and Tolerances, and on Fire Hazards. The report of the Sub-Committees on Theatre Design refers to the projected glossary of terms used in the theatre design and discusses the question of staggered seating in theatres.

A QUESTIONNAIRE has been formulated to secure a cross-section of data in relation to (1) the trend in current consumption for the various electrical units used in theatres throughout the country; (2) the total cost of elecric current; (3) energy consumption charges; and (4) the average proportions of power used for projection, air-conditioning, lighting, *etc.*

The Committee felt that about 1600 of these survey reports, representing about 10% of the total number of theatres, should be received before attempting to summarize the data obtained. Up to the present time, 1300 reports have been received. However, some of them will have to be discarded because of incompleteness of the data submitted. The present report on the data received is therefore preliminary, to indicate principally the nature and purposes of the study being conducted by the Working Committee on the Power Survey.

It is expected that a final and complete report will be available at the next Convention of the Society.

Very few industries operate with as great a variety of electrical equipment as is found in motion picture theatres. Motors as small as 1/20 hp. are used on ticket machines, and motors 300 hp. in size have been found operating compressors on refrigeration equipment. Projection rectifiers and motor-generator sets in general use range from 3 to 40 hp. Besides power required for incandescent and neon lighting, and radios, additional power is needed for motors used for many purposes.

60-Cycle Power Predominates

A study of the forms of power available in various sections of the country has been undertaken (Table 1), with the result that it has been found that 60-cycle alternating current is the standard for power distribution and is almost universally available. More than 95% of the distributed a-c power for general use is at a frequency of 60 cycles. This does not include railways and certain large industries using 25-cycle supply.

A frequency of 50 cycles is used in all of southern California and in the vicinity of Los Angeles. although not in the city proper where the 50-cycle supply has recently been converted to 60 cycles. There are no plans to change to 60 cycles generally in southern California.

Forty-cycle power is used to a limited extent in New England, principally in Rumford Falls, Me., and in Palmer Falls and Plattsburg, N. Y. Plattsburg has also 60-cycle power. In and around Buffalo the 25-cycle supply for general distribution has been largely supplemented with 60-cycle power, although the heavy industries remain on 25 cycles. Niagara Falls has switched from 25 to 60 cycles

A small area in central New York State, north of Oneonta, is supplied with 25-cycle power, and also Keokuk and Ft. Madison, Iowa, and nearby communities. Around Geneva and Auburn, N. Y. the frequency is 62½ cycles.

Certain of the larger cities have direct current available in certain districts, but in practically all these districts 60-cycle alternating current is also available. These cities are Cleveland, Chicago, New York, Baltimore, Detroit, Boston, Kansas City (Mo.), New Orleans, Washington (D. C.), St. Louis, and Cincinnati.

There has been a tendency on the part of the large power companies to standardize on 120 volts for lighting and 208 volts for power service. The power companies in many cases meter the power supply on the primary or high-voltage side of the transformers, whether company-owned or theatre-owned transformers are used, this procedure resulting in an increased number of kwh. charged tc the theatre. A lack of uniformity exists in the rates in various localities even where one power company operates in adjacent areas.

The data received indicate that power rates range from a minimum of 1.14c to 6c per kwh., up to 6000 kwh. a month; 1.13c to 4.06c up to 15,000 kwh. a month; and from 0.99c to 2.49c up to 30,000 kwh. a month. The committee has compiled a chart covering 57 widely separated cities of populations greater than 50,000, showing the power available in terms of voltage, phase, and frequency, and the minimum and maximum costs per kwh. in the three power-consumption brackets namely, 6000, 15,000, and 30,000 kwh. per month. This chart clearly shows the lack of uniformity in rate structure and accounts for some of the complaints of theatre owners on excessive power bills.

Widely Varying Rates

Thirty widely separated cities were selected to determine minimum and maximum costs of operating lighting and power equipment. This analysis shows that charges to a theatre having a load of 6 kw., using 750 kwh. per month for lighting only, ranged from a minimum of $22 for Los Angeles, Calif., to a maximum of $56 for Miami, Fla. A load of 12 kw. (lighting), with a consumption of 1500 kwh., led to charges from $41 to $105 for the same cities.

The analysis disclosed also the fact that for a 12-kw. load, at 1500 kwh. a month, the cost is $22 for Seattle, Wash., and $67 for Boston, Mass. A 30-kw. load, at 6000 kwh. a month, costs $68 in Seattle and $219 in Chicago. A 75-kw. load, at 15,000 kwh. a month, costs $178 in Los Angeles and $360 in Denver. A 75-kw. load, at 30,000 kwh. a month, costs $295 in Los Angeles and $537 in Jacksonville, Fla.

The questionnaire charts distributed widely throughout the industry will show the number and proportion in use of arcs, according to types and power sources, the average seating capacities of theatres, picture sizes, and many other factors. Charts are being prepared showing the proportion of power used and the corresponding costs, for the various theatre functions, including projection, lighting, refrigeration, *etc.*, and graphs are being prepared showing the average total costs of power in different localities.

It is believed that these graphs will enable exhibitors to determine whether or not they are operating with average electrical efficiency and economy. The survey indicates that an amount of the order of 20 million dollars a year is expended for electric power to operate theatre equipment, for a power consump-

†J. Soc. Mot. Pict. Eng., Dec. 1940.

tion ranging from 600 to 800 million kwh. yearly, and for a connected capacity exceeding 600,000 kw.

Tools and Tolerances Data

For many years it has been the viewpoint of the Projection Practice Sub-Committee that a study should be made of projector mechanisms in use in theatres to determine the best operating adjustments for various tension devices, the limits of permissible or tolerable wear of mechanical parts, and methods of determining these factors. The corresponding measurements require that consideration be given to the development of inexpensive tools as an aid in making such determinations in the theatre.

After a careful study of the projector and sound-head mechanisms, the Working Committee on Tools and Tolerances picked as its first objective the determination of the most suitable gate tension consistent with tolerable picture jump.

TABLE 1. ***Power available in various cities of U. S.***

				30 Kw 6000 Kwh		75 Kw 15,000 Kwh		75 Kw 30,000 Kwh	
	Voltage	Phase	Cycles	Min.	Max.	Min.	Max.	Min.	Max.
Albany, N. Y.	120–208	1–3	60	2.35		1.69	2.11	1.09	1.46
Atlanta, Ga.	120–208	1–3	60	2.01	3.44	1.79	2.05	1.45	1.57
Atlantic City, N. J.	120–208	1–3	60	3.03	3.06	2.46		1.70	
Baltimore, Md.	120–208	1–3	60	2.85		2.45		1.79	
Boston, Mass.	120–208	1–3	60	2.95	2.98	2.40	2.59	1.56	1.64
Brockton, Mass.	120–208	1–3	60	2.64		1.95	2.21	1.36	1.49
Buffalo, N. Y.	120–208	1–3	25 & 60	1.51		1.05	1.69	.80	1.05
Canton, Ohio	117½–204	1–3	60	2.97	3.00	2.22		1.50	
Chicago, Ill.	120–208	1–3	60	3.34		2.05	2.53	1.52	1.76
Cincinnati, Ohio	120–208	1–3	60	2.77	2.96	2.25	2.42	1.52	1.74
Columbus, Ohio	120–208	1–3	60	2.02	2.22	1.81	2.12	1.31	2.06
Dallas, Texas	115–230	1–3	60	2.69		2.21		1.57	
Dayton, Ohio	114–199	1–3	60	2.58		2.27		1.40	1.75
Denver, Col.	120–208	1–3	60	2.60		2.40		1.63	
Detroit, Mich.	120–208	1–3	60	2.85	2.99	2.58		1.66	
	120–240	1–3	60						
Evanston, Ill.	115–200	1–3	60	3.01	4.24	2.47	2.72	1.71	1.83
Fort Wayne, Ind.	120–208	1–3	60	1.75		1.59	2.14	1.40	1.55
Fort Worth, Tex.	120–208	1–3	60	3.00		2.41		1.70	
Harrisburg, Pa.	120–208	1–3	60	2.79	3.53	2.21	0.47	1.47	1.49
Houston, Texas	122–211	1–3	60	2.13		2.17	2.19	1.44	1.46
Indianapolis, Ind.	120–208	1–3	60	1.83	3.06	1.90		1.33	
Knoxville, Tenn.	115–199	1–3	60	1.30		1.30		.95	
Lincoln, Neb.	120–208	1–3	60	1.46	2.24	2.04	1.97		
Long Beach, Calif.	120–208	1–3	50–60	2.03	2.82	1.51	2.65	1.22	1.70
Louisville, Ky.	120–208	1.3	60	2.51	2.53	1.97		1.36	
Lynn, Mass.	120–208	1–3	60	2.63		1.76		1.64	
Madison, Wis.	120–208	1–3	60	1.65	2.24	1.56	2.16	1.16	1.62
Memphis, Tenn.	120–208	1–3	60	1.73		1.13		1.57	
Miami, Florida	115–230	1–3	60	2.27	4.03	2.75		2.05	
Milwaukee, Wis.	120–208	1–3	60	2.10	3.22	1.79	2.54	1.44	1.90
Minneapolis, Minn.	120–208	1–3	60	2.55	2.88	1.91	2.47	1.46	1.84
Mount Vernon, N. Y.	120–208	1–3	60	3.87	4.81	2.94	4.06	2.11	2.55
New Orleans, La.	120–208	1–3	60	2.68		2.06	2.40	1.48	1.65
New York, Bronx	122–211	1–3	60	5.16		2.52	3.46	1.97	2.39
Brooklyn	122–211	1–3	60	4.86		2.57	3.46	1.67	2.39
Manhattan	122–211	1–3	60	5.16		3.17	3.46	2.09	2.39
Queens	122–211	1–3	60	3.44	5.16	2.13	3.46	1.64	2.39
				2.97	6.00	1.99		1.48	
Richmond	110–220	1–3	60	3.17	3.39	2.24		1.70	
Newark, N. J.	120–208	1–3	60	3.12		2.47	3.05	1.57	2.00
Oak Park, Ill.	115–199	1–3	60	3.61	4.24	2.47	2.72	1.71	1.83
Oklahoma City, Okla.	120–208	1–3	60	2.17	4 00	1.98		1.21	1.51
Philadelphia, Pa.	115–230	1–2	60	2.84		1.90	2.01	1.25	1.30
Pittsburgh, Pa.	115–199	1–3	60	2.37		1.96		1.23	
Portland, Oregon	123–213	1–3	60	1.14	2.37	1.53	1.87	1.16	1.38
Providence, R. I.	120–208	1–3	60	1.74	2.17	1.77	1.80	1.22	1.30
Richmond, Virginia	120–208	1–3	60	2.37		1.65	2.22	1.33	1.73
Rochester, N. Y.	120–208	1–3	25 & 60	2.74	2.99	1.97	2.64	1.27	1.61
St. Paul, Minn.	120–208	1–3	60	2.68	2.88	2.07	2.77	1.59	1.86
San Antonio, Tex.	120–208	1–3	60	2.06	2.14	1.63	1.86	1.09	1.22
San Francisco, Cal.	122–211	1–2–3	60	1.47	1.93	1.54		1.19	
Scranton, Pa.	120–208	1–3	60	2.44	2.97	1.75	2.33	1.27	1.61
Seattle, Wash.	120–208	1–3	60	1.14	2.05	1.42	1.77	.99	1.11
		1–3	60						
South Bend, Ind.	120–208	1–3	60	2.68	2.97	2.21		1.57	
Spokane, Wash.	120–208	1–3	60	1.33	1.87	1.77		1.23	
Springfield, Mass.	120–208	1–3	60	2.00	2.91	2.51	3.83	2.67	1.67
Toledo, Ohio	120–208	1–3	25 & 60	3.120	4.34	2.30	2.79	1.55	1.84
Washington, D. C.	120–208	1–3	60	2.00	2.29	1.61	2.16	1.32	1.62
Wichita, Kansas	115–199	1–3	60	2.54		2.24	2.69	1.41	1.59
Wilmington, Del.	120–208	1–3	60	2.49	3.09	2.13	2.47	1.50	2.31
Worcester, Mass.	120–208	1–3	60	2.58	3.10	1.85	3.36	1.36	2.49
Yonkers, N. Y.	120–208	1–3	60	3.67	4.27	2.52	3.49	1.83	2.23

In order to coordinate the work with any data available from other sources, various projector manufacturers were consulted as to what standards of gate tension were employed during manufacture of the equipment. The replies disclosed the fact that only one manufacturer set a definite numerical standard for picture-gate tension, the others depending upon experienced mechanics to make adjustments through observation of actual operation of the machine.

For experimental studies, two types of spring tension gauges were used. Results obtained by the form that pulls a piece of film through the gate were not sufficiently consistent. The other form, which measured the pressure of the tension shoe, gave more nearly uniform readings; however, it can be used only with the gate removed from the projectors.

During the past few months, tests have been made on projectors in theatres throughout the New York area and it was found that the tension shoe pressure varied considerably from theatre to theatre, and between projectors in the same theatre. At the present time attempts are being made to determine the minimum pressure that can be used while yet keeping the picture jump within allowable limits. At the same time a study will be made to determine how picture-gate tension affects the wearing of the intermittent sprocket teeth and the sprocket-holes in the film.

Report on Fire Hazards

Last year the report on fire hazards comprised an extensive proposed revision of the "Regulations" of the National Board of Fire Underwriters for nitrocellulose motion picture film, as recommended by the National Fire Protection Association.

The Committee is pleased to report that these recommendations were adopted by the N.B.F.U. and the N.F.P.A. almost in their entirety and were published on July 1, 1939, as N.B.F.U. Pamphlet No. 40.

Last spring an invitation was received by the Committee from the National Fire Protection Association to delegate a person to address the meeting of the fire marshals on the opening day of the N.F.P.A. Convention, May 7, 1940, at Atlantic City, N. J. Mr. Sylvan Harris was appointed to attend the Convention and to make the address. The valued cooperation of the State of Connecticut was received, through the official appointment of Inspector E. A. Morin to attend the Convention and present a special exhibit of a model projection room and other displays to the delegates.

The address included a general review of the efforts of the motion picture in-

(*Continued on page* 28)

Television Had Tumultuous Year in 1940

By *W. R. G. BAKER*, Television Division, General Electric Co.

The year 1940 has been a rather tumultous one for television. The original standards submitted by the RMA were found inadequate by the Federal Communications Commission, after two hearings which took place early in the year. The failure of television to obtain a "green light" from the F.C.C. for commercial service resulted in the withdrawal of all merchandising plans and a very decided loss of interest on the part of the consumer.

In a pronouncement by the F.C.C. dated May 28, 1940, it was stated: "Full commercialization of television was today promised by the F.C.C. as soon as the engineering opinion of the industry is prepared to approve any one of the present competing television systems."

As a result of this statement, there was established the National Television System Committee sponsored by the R.M.A. with the approval of the F.C.C. The purpose of the N.T.S.C. represents the radio industry rather than any association as evidenced by the fact that a total of 41 companies and research and engineering organizations have representatives on either the main committee or the panels. The N.T.S.C. is comprised of 15 members, 12 alternates, and the total membership including the panels is 137.

Difficult Standards Problem

The industry through its representation on the N.T.S.C. is faced with the problem of establishing standards which on the one hand are sufficiently broad to permit the inclusion of future developments and at the same time will not unduly delay commercial television. While the problem of standards for a monochromatic system of television are sufficiently difficult, the complexity has been increased through the need for consideration of two- and three-color television systems plus the possible application of frequency modulation.

The F.C.C. has scheduled an informal conference for January 27 at which time the N.T.S.C. will submit a status report on the work.

Field tests made by General Electric in the Helderberg Mountains in 1939 proved it to be feasible to receive directly telecasts from New York with sufficient signal strength and quality to justify rebroadcasting them through W2XB, the company's television station in the Helderberg Mountains. Hence a permanent relay station was erected and placed in regular operation in 1940, and is the pioneer step in chain broadcasting, conceded as essential in overcoming the cost difficulties of television programs.

The station consists of a large rhombic receiving antenna, a signal amplifier and receiver, a 10-watt relay transmitter operating on a frequency band of 156-162 mc., and a directional transmitting antenna. At the main transmitter, 1½ miles away, there is located a directional receiving antenna and a converter is located whose output drives the transmitter of W2XB. New distance records for consistent television reception were established by reception of the retelecasts which originated in N. Y. City by a receiver located on Whiteface Mountain in the Adirondacks.

CBS COLOR TELEVISION SHOW

As a sequel to last October's showing of film pickup of color television, CBS recently gave its initial demonstration of direct pickup of color television via pictures which were taken by a tele camera in headquarters of CBS, then transmitted by the coaxial cable under 52nd St., and then shown in the CBS annex across the street.

Maps, gloves, fabrics, stockings, color charts, confetti and the making of a salad were shown to dramatize the effectiveness of color over black and white. Next to the television color receiver was placed a set showing black and white images to show contrast. Pictures were clear and eye-arresting on the whole. Color of red seemed somewhat pronounced to some observers but the theatrical advantages color possesses over black and white was conceded by those who attended.

Early Emergence from Lab.

Dr. Peter C. Goldmark, chief television engineer, in commenting on the progress, declared: "The results, thus far, in all phases of color television are most encouraging and it would appear that an answer has been found to every fundamental problem. From now on I think, we can progress steadily even if we have nothing more than straightforward engineering effort looking toward commercial application. Today color television is in the laboratory, but with the co-operation of the industry, I do not think it will be there long."

NEW COLOR FILM PROCESS

Dr. C. E. Mees, director of research for Eastman Kodak Co., has disclosed a new, quicker and better process for developing color motion pictures. The discovery substitutes a single operation, resembling the production line of automobile manufacture, for three separate developments formerly necessary. The result, Dr. Mees said, was better quality and less risk of damage to the film.

The emulsion on this film is in three superimposed layers, taking three images, one directly over the other. The top image is taken in blue light, as the top layer is sensitive to blue alone. The middle image is taken in green and the bottom in red light.

When this film is developed all the layers

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are plain black and white. Each layer then has to be dyed the complement respectively of blue, green or red, the primary colors. The dyes have to be put on separately and under the old process this required a separate developing and drying for each color.

Continuous Developing Run

Under the new process the film goes into a continuous run. First the black and white images appear. Next, the film moves along to where red light shines through the back layer, which is sensitive only to red and can be developed to color in this way without affecting the two layers above. In the third stage the blue light shines on the film from above.

Finally the film passes into green light, which affects only the middle layer. A lot of green has to be used to penetrate, but this does not affect the other two layers which are already dyed.

The film is then dried and used in projectors, where the dyes reproduce the hues of the original scene.

BOSTON LOCAL 182 ELECTION

Thad C. Barrows has been re-elected president of I. A. Local 182, Boston projectionists, marking his 24th consecutive year as president during the 30 years he has served as a L. 182 official. James F. ("Jimmy") Burke, business representative, who can also boast a long period of service to L. 182, still has another year to go on his present term.

Other officers named were Joseph Rosen, treasurer; Bernie McGaffigan, vice-president; A. R. Moulton, fin. secretary; James O'Brien, sgt.-at-arms, and an executive committee composed of Louis Pirovano, John Diehl, and Joseph Nuzzolo.

MINNEAPOLIS L. 219 ELECTION

Results of election of officers for Minneapolis Local 219 of the I. A. are as follows: C. J. Hubbard, president for his third term; W. J. Yutzy, business representative; L. T. Olson, trustee; A. W. Harris, sgt.-at-arms; G. E. Lauren and C. J. Hubbard, executive committee, and W. J. Christiansen and H. H. Babb, examining board

KILL CLEVELAND 16MM. BILL

Proposal that all users of film 16 mm. or wider be compelled to obtain licenses in much the same manner as do professional projectionists was killed by the City Council of Cleveland, Ohio, after some 300 objectors stormed a Council hearing on the topic. The Commissioner of Buildings, who sponsored the ordinance, ran into some stiff opposition to his plan, notably that from the Fire Chief, who stressed the fact that most non-theatrical film is of the "safety" or slow-burning variety. Ordinance had the support of Cleveland Federation of Labor.

LESTER ISAAC, LOEW CHIEF, WEDS

Announcement has been made of the marriage of Lester B. Isaac, projection chief of Loew's Theatres, Inc., to Miss June Glassberg, of New Haven, Conn. After an extended honeymoon trip through the South, the couple will reside in New York City.

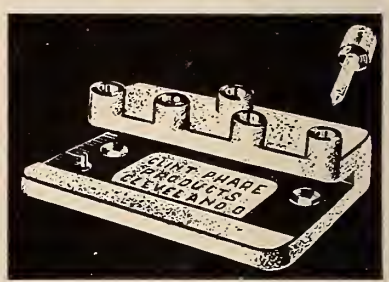
BANS MOVIES IN TAVERNS

What may prove to be the answer to the vexing problem (to I. A. unions) of free movies in taverns which serve liquor is the action of Worcester, Mass., authorities in ruling that such showings are illegal on the ground that since a requirement for a liquor license is that the place be well lighted, it would not be possible, or at least feasible, to show movies.

LABOR PACT GOES WITH HOUSE, DECREES N. Y. ARBITRATOR

Handing down an award recently favoring I. A. Local 306, projectionists' union in N. Y. City, in the Sheldon Theatre-305 case, former Chief Justice Frederick E. Crane, of the N. Y. Court of Appeals, neutral arbitrator in the case, set an im-

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portant precedent in ruling that a new lessee or owner must assume labor obligations contracted by the former lessee or owner.

The Sheldon, covered by the ITOA contract signed with the Local in 1937, changed hands in 1938. The three L. U. 306 projectionists working there were discharged. Under terms of the ITOA contract, the men would have earned over $13,000 in wages in the time they have been out of the house; but the arbitrator assessed a judgment of $7,500 against the theatre due to the fact that the men have had "some" employment since that time. Crane also assessed costs of $1,146 against the owners of the theatre.

Contained in the award signed by Crane is an injunction which will prevent employers from violating terms of the ITOA contract, and allows recourse to the Supreme Court on contempt charges where such violations are made. Crane, in his award, stated that, speaking for himself, "he felt that the transfer of operations in this instance was not a bona fide change of employer's interest."

Four more similar cases are pending, and four other cases of a similar nature exist where charges have not yet been filed.

Ontario Projectionist Training Scheme Draws Labor Fire

Canadian members of the I.A.T.S.E. are seriously concerned about the inauguration by the Ontario Government of a projectionist training scheme which, say provincial authorities, is designed to provide skilled replacements for those projectionists who may be called for military service. The school will offer a 12-months course, and the pupils will pay a fee of $100.

Labor's objection to the proposed course is that there exists now no shortage of skilled projectionists, and that not even the demands of military training will occasion such a shortage. It is pointed out that many competent projectionists still are unemployed, the ranks of whom will be swelled appreciably by the government's training course. Government stand is that since they issue licenses and also inspect theatres for fire protection, with the greatest fire hazard in the projection room, they also should pass on the type of training had by applicants for licenses. Moreover, army enlistments are held certain to deplete projectionist ranks.

Not only the I.A.T.S.E. but all Canadian labor groups are exerting strong pressure on the Government to abandon the project, since they fear that once such a program gets underway it will be extented to many other crafts, to the detriment of all unions. Union opposition, although intense, has thus far failed to upset the training plans.

LOEW NET NEARLY 9 MILLION

A net profit of $8,908,469.74, representing all corporations, was reported by Loew's, Inc., for the year ended Aug. 31, 1940, according to the annual statement issued



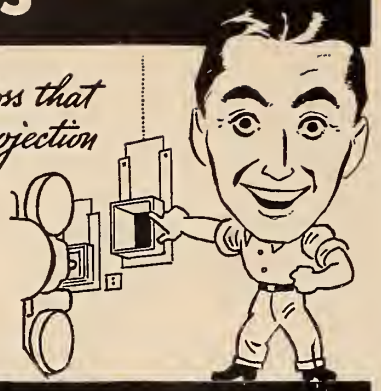
Few of the customers know the part he plays

Of all the people who come into a theatre to enjoy a picture, very few realize the outstanding part the projectionist plays in making the show enjoyable to them. Very few of the customers suspect that machinery of the greatest delicacy must be manipulated ably, expertly, if the show is to hit the sheet the right way. But the projectionist knows, and the Altec service man, who visits the projection room at regular intervals, knows it too. And if the show hits the sheet the right way, that's a source of justifiable professional pride to both of them—even if the customers don't know.

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Only complete reels, as described below, are available (no short sections or single frequencies). The prices given include shipping charges to all points within the United States; shipping charges to other countries are additional.

35-Mm. Visual Film

Approximately 500 feet long, consisting of special targets with the aid of which travel-ghost, marginal and radial lens aberrations, definition, picture jump, and film weave may be detected and corrected.

Price $37.50 each.

16-Mm. Sound-Film

Approximately 400 feet long, consisting of recordings of several speaking voices, piano, and orchestra; buzz-track; fixed frequencies for focusing sound optical system; fixed frequencies at constant level, for determining reproducer characteristics, frequency range, flutter, sound-track adjustment, 60- or 96-cycle modulation, etc.

The recorded frequency range of the voice and music extends to 6000 cps.; the constant-amplitude frequencies are in 11 steps from 50 cps. to 6000 cps.

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recently. Profit is equal to $65.16 per share on the outstanding preferred stock, and $4.82 per share on the common stock, after deducting preferred dividend.

U. S. POWER SURVEY RESULTS

(*Continued from page* 24)

dustry to improve the design and operation of motion picture projection rooms. and particularly from the standpoint of fire prevention and fire control. Attention was called to the chaos that existed in such matters a number of years ago when the Society first began to issue its recommended projection room plans. The recent general improvement in conditions was described, but attention was called to the fact that even at this late date numerous inconsistencies and conflicts exist throughout the country in the fire regulations and building codes of the various states and municipalities.

The building codes for motion picture theatres require much revision and standardization, and a plea was made that steps be taken to correct the situation. An invitation was extended to the fire marshals, the N.F.P.A., the N.B.F.U., and various other organizations to cooperate with the S.M.P.E. in presenting to the fire prevention authorities all over the country the need for greater uniformity and logical consistency in the establishment of fire regulations.

Some items not covered in the previously mentioned revision of the N.F.P.A. "Regulations" are still under consideration, and the Working Committee on Fire Hazards intends to have material on these matters ready for a report at the next Convention.

There are also under consideration the possible ways of acquiring reliable and complete information as to the causes of film fires in projection rooms and also means for analyzing the data as obtained.

Among the activities of the Sub-Committee on Theatre Design is a project that is sufficiently advanced for presentation at the Spring Convention, 1941. This project involves preparing a glossary or system of nomenclature of terms for use in connection with the subject of theatre design.

Lack of consistent and clear nomenclature has handicapped the work of this Sub-Committee, and also has led to the confusion existing in the field because of certain inappropriate terms as well as multiplicity of terms sometimes used in reference to the various items of consideration in theatre design.

All phases of theatre design are covered in the compilation of this glossary. Included are the acoustic, seating, viewing, traffic, projection, auditorium and auditorium lighting and ventilating phases. Approximately 250 terms have been compiled with the aid of engineers

and architects in the various fields of endeavor connected with this work.

The Sub-Committee is now occupied in formulating the proper definition for these terms. In many instances certain terms and definition will be taken from sources already established as standard.

This Sub-Committee has also made a study of the use of staggered seating in motion picture theatres. Staggered seating exists in all theatres in which the seating width of the auditorium is greater than fourteen seats. This is so because of the magnitude of the angle subtended to the screen from positions on either side of the centrally located fourteen seats, and also because the seats are initially placed directly behind one another in lines parallel to the center-line of the auditorium. In these cases, however, the stagger effect does not exist in the central bank of chairs when the chairs are placed directly behind one another in lines parallel to the center-line of the auditorium.

Some Obstruction Difficulties

It was noted that the view of the screen was unobstructed from the side seats, which had the stagger effect, whereas serious obstruction of the view of the screen was evident in the same theatre on the same floor slope from the centrally located seats. It has been found generally that the usual floor slope in the motion picture theatre auditorium was sufficient for the side seating sections having the stagger effect, but not sufficient for the central seating section.

It has also been found that if the floor slope were to be increased to make it possible to have unobstructed vision of the screen from the central section of seats, the slope would be excessive and dangerous from the hazard standpoint and would create serious difficulties in the functional design of the theatre. In many cases the screen has been placed at an undesirable height above the floor to overcome obstruction difficulties.

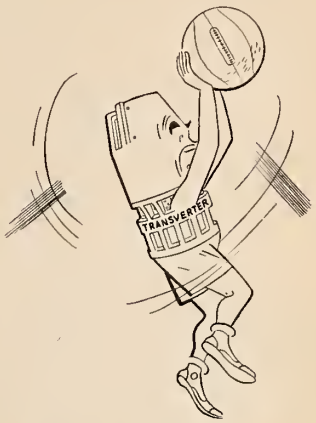
It is therefore proposed that where floor slopes become too great for unobstructed viewing of the screen or where the screen would otherwise be placed too high, the central section of seats be placed so that a stagger effect is produced. This means that every alternate row of seats in the central section would have only one seat less than the row behind, or before, and would result in a total loss of seats amounting to only about 1½% of the total.

It is also proposed that in existing motion picture theatres having inadequate floor slopes, the central section of seats be reset according to a stagger system. It is not necessary to stagger the seats in a certain number of the rows nearest the screen because the amount of stagger does not leave sufficient space between the heads of the preceding spectators to permit a view of the entire picture from those rows. Since only a nominal floor slope is necessary under those seats to achieve unobstructed vision, the seats in this area can be arranged on a non-stagger plan.

Attention is directed to the desirability of a requirement relative to staggered

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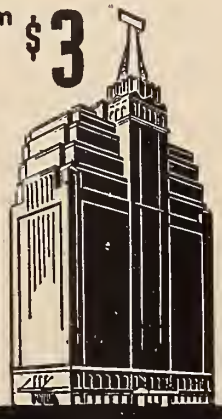
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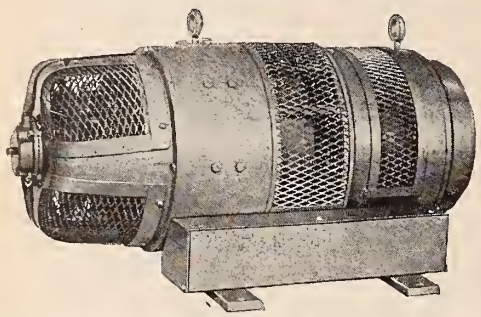
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seating laid down by the State of Connecticut. This regulation permits staggered seating provided that the aisle line remains unbroken. This unbroken line is made possible by the use of end-of-row chairs of different width so arranged as to maintain the stagger effect.

PROJECTION OPTICS DATA

(*Continued from page* 12)

crease 3/32″, therefore we have a new focus of 5 1/32″.

By dividing this new focus into the new working distance of 34″, it will be found that we have a ratio of 6.75; and this multiplied by the crater diameter of 5.75 mm. will produce a "spot" at the aperture 38.8125 mm. in diameter. At 32″ the 5.75 mm. crater, having an area of 25.9 square mm., was enlarged to approximately 1011.1 square mm. at the aperture. At 34″ this same crater is magnified to 1182.3 square mm. Thus a difference of 171.2 square mm. greater area is created and the speed of the mirror is reduced.

This 2″ change in the working distance has brought about an excessive magnification of the "spot" at the aperture, as we can see by comparing the area of the "spot" formed at 32″ (which resulted from the imaging of an 8 mm. carbon at 32″ producing a "spot" with an area of 1011.1 square mm.) and the "spot" formed at 34″, which was 1182.3. Therefore, by subtracting these two we find we have a difference of 171.2 square mm. in area at 34″ which is virtually a loss in efficiency as the greatest majority of this additional area falls uselessly outside the aperture.

The only gain to be obtained might be a better lens-reflector speed matching in the case of a very slow objective lens, in which this distance might match this speed and increase the distribution but which for most practical purposes would be a wasteful procedure. If we magnify the crater of the arc beyond the limits that are absolutely necessary to optimumly cover the field of the aperture, losses in efficiency are certain to result.

As a great many projectionists are working with modern projection arc lamps but still are utilizing slow-speed objective lenses, they are losing the many advantages offered with modern high-intensity projection arc lamps, and the high-speed projection mirrors which they use do not match the slow, small lenses.

All calculations in this article are based on first-surface reflectors—that is, reflectors in which the light is reflected directly from the first surface—and do not in every case hold true for silver-backed glass type mirrors in which the refraction through the surface of the glass must be taken into consideration.



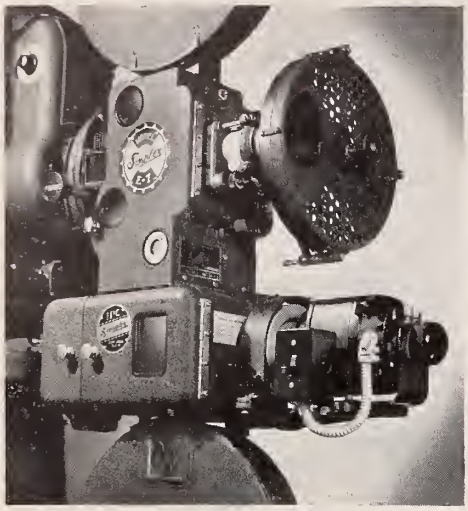
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